US006419321B1

(12) **United States Patent**
Sack

(10) **Patent No.: US 6,419,321 B1**
(45) **Date of Patent: Jul. 16, 2002**

(54) **ADJUSTABLE HEAD SUPPORT FOR CONNECTION TO A WHEELCHAIR**

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(73) Assignee: **Wonderland Nursery Goods, Co., Ltd.**, Taipei (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/517,284**

(22) Filed: **Mar. 2, 2000**

Related U.S. Application Data

(60) Provisional application No. 60/122,396, filed on Mar. 2, 1999.

(51) **Int. Cl.**[7] **A47C 7/36**
(52) **U.S. Cl.** **297/405**
(58) **Field of Search** ..... 297/391, 405, 297/406, 408, 410, DIG. 4; 248/118

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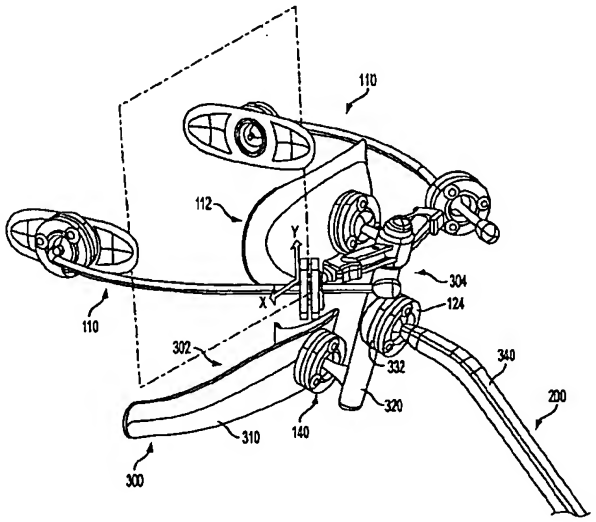
Primary Examiner—Milton Nelson, Jr.
(74) *Attorney, Agent, or Firm*—Hogan & Hartson LLP; Matthew T. Bailey, Esq.

(57) **ABSTRACT**

A head array for a wheelchair includes a temple support, an occipital support, a sub-occipital support, and a support structure for adjustably mounting the temple support, the occipital support and the sub-occipital support. Also shown is a support structure for a wheelchair head array including a horizontal channel adapted to receive a first component of a wheelchair head array and a vertical channel adapted to receive a second component of a wheelchair head array, the vertical channel being attached to the horizontal component.

10 Claims, 67 Drawing Sheets



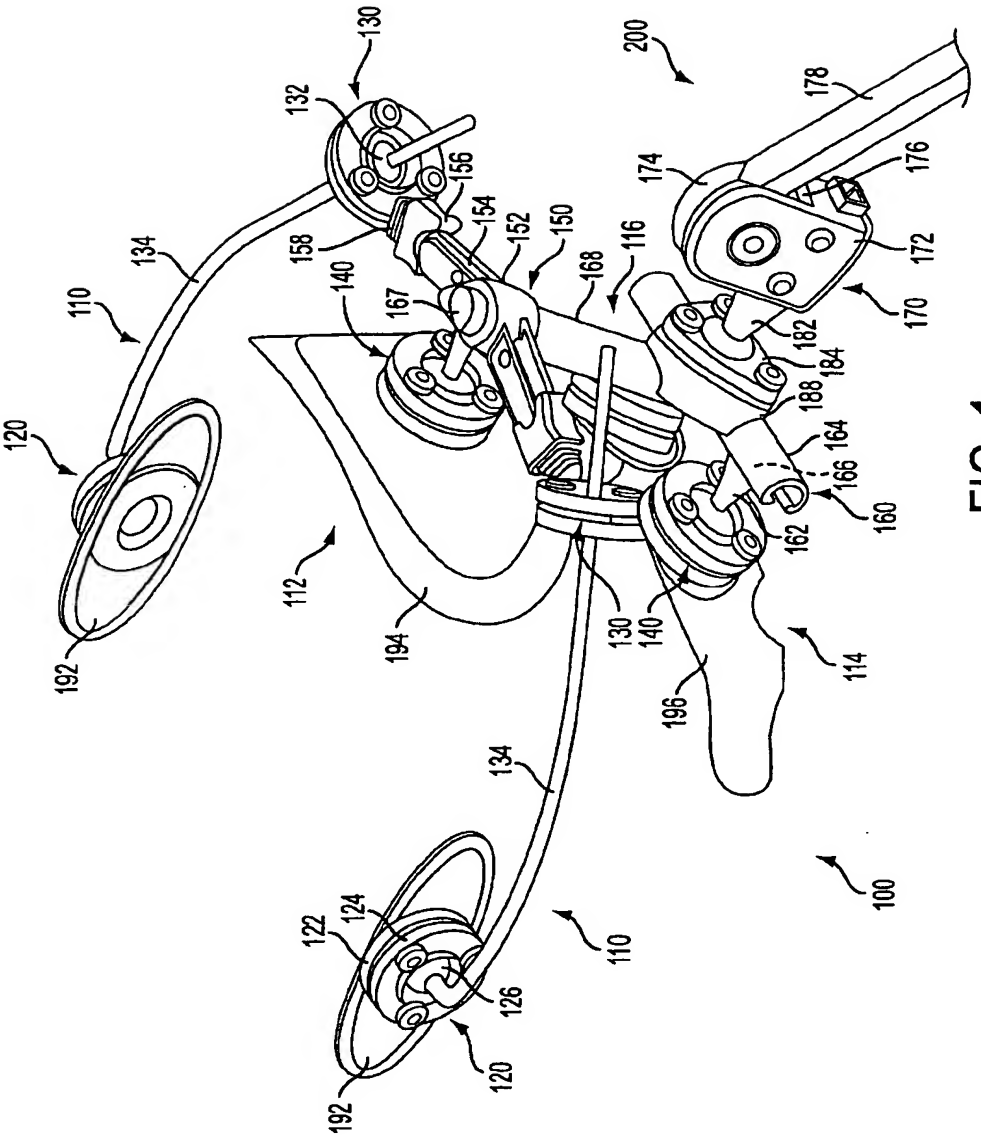

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FIG. 1

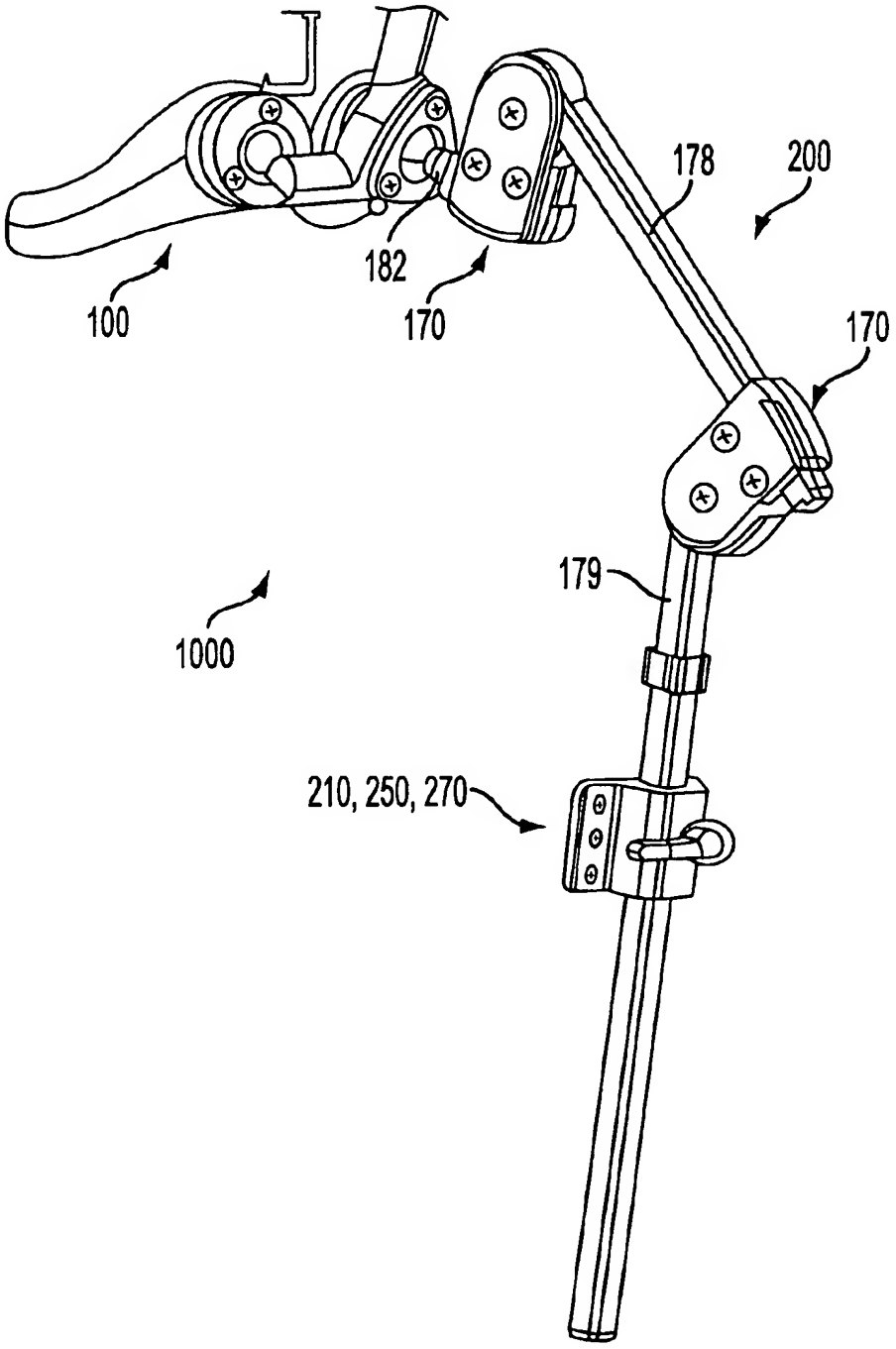


FIG. 2

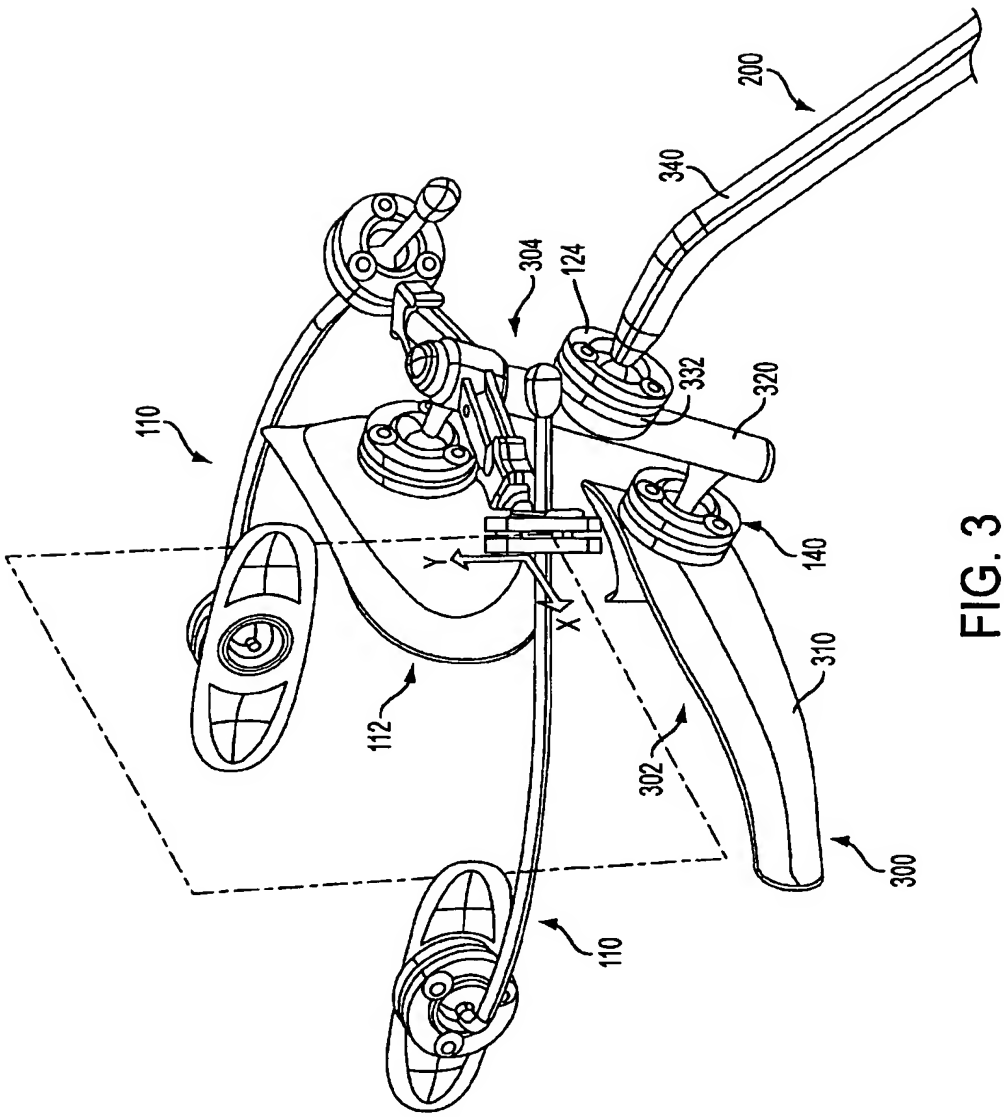


FIG. 3

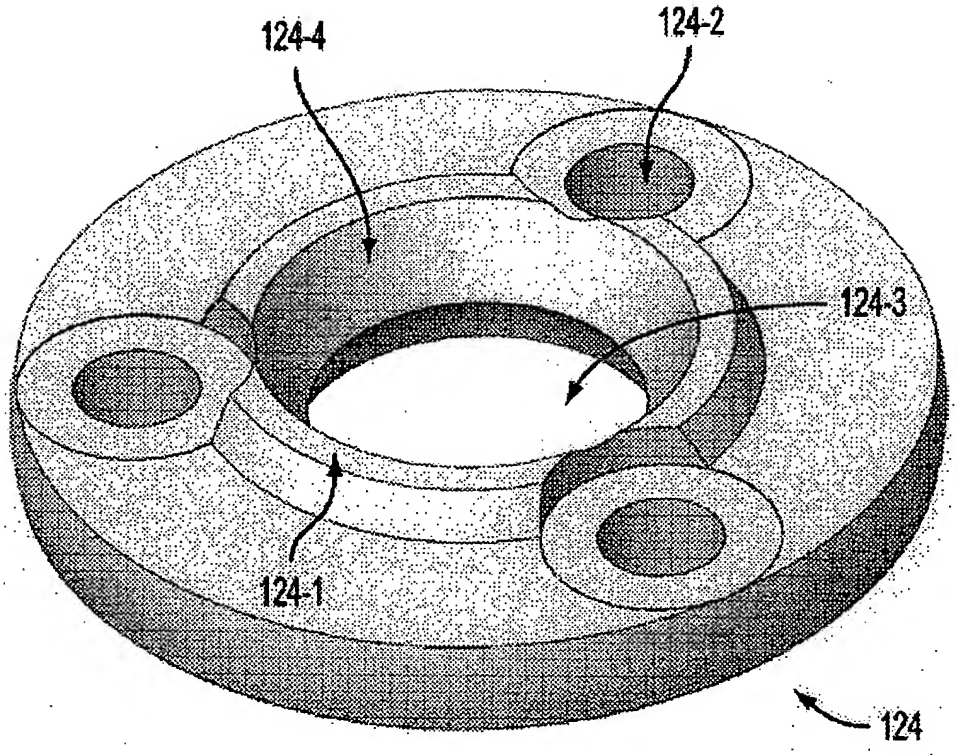


FIG. 4A

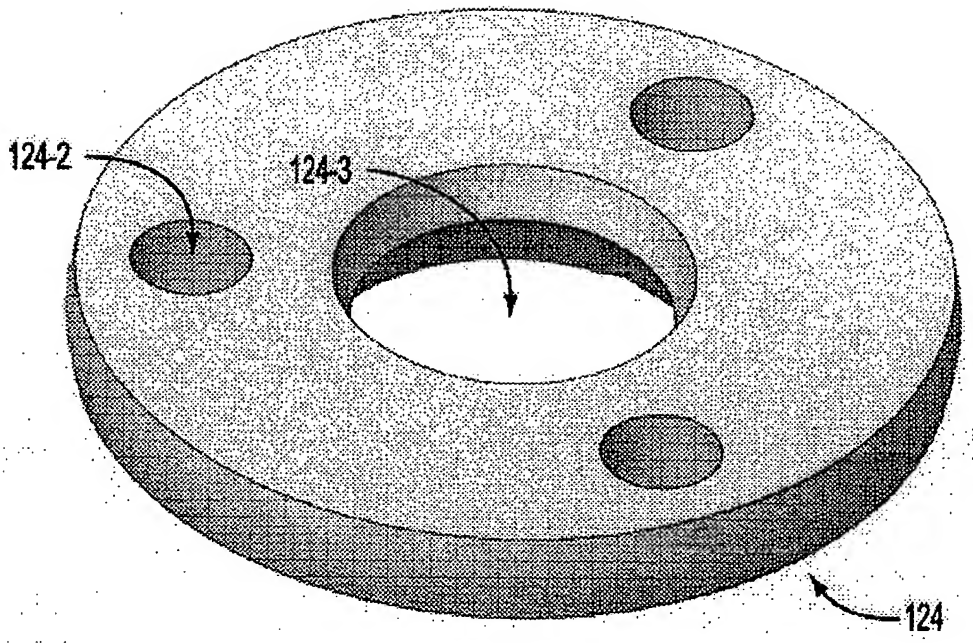


FIG. 4B

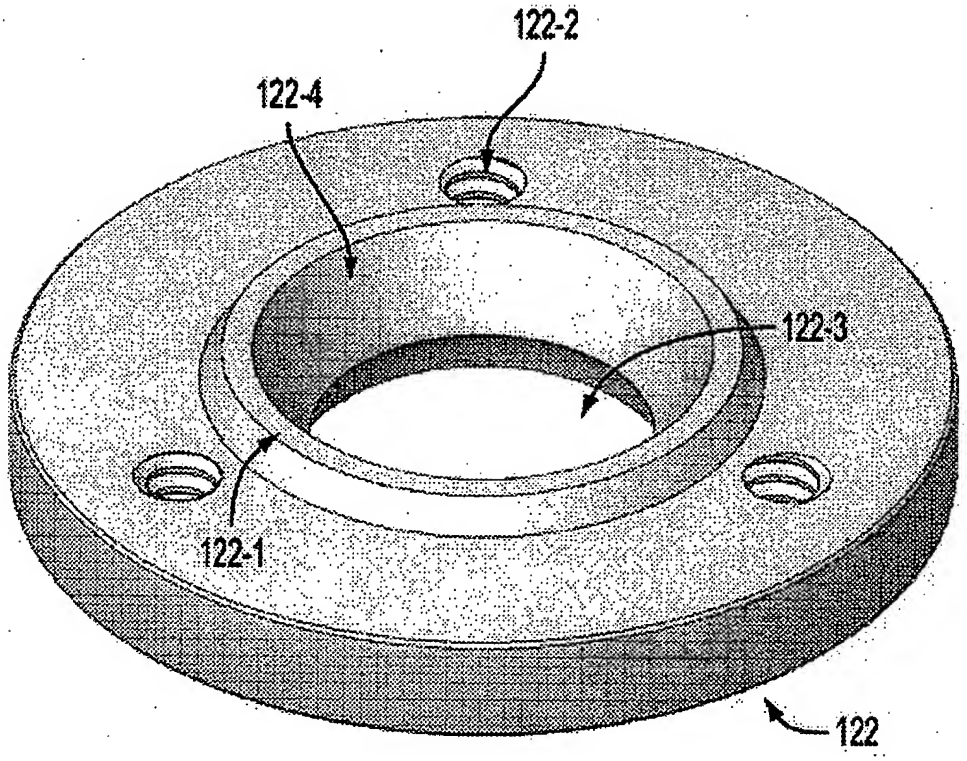


FIG. 5A

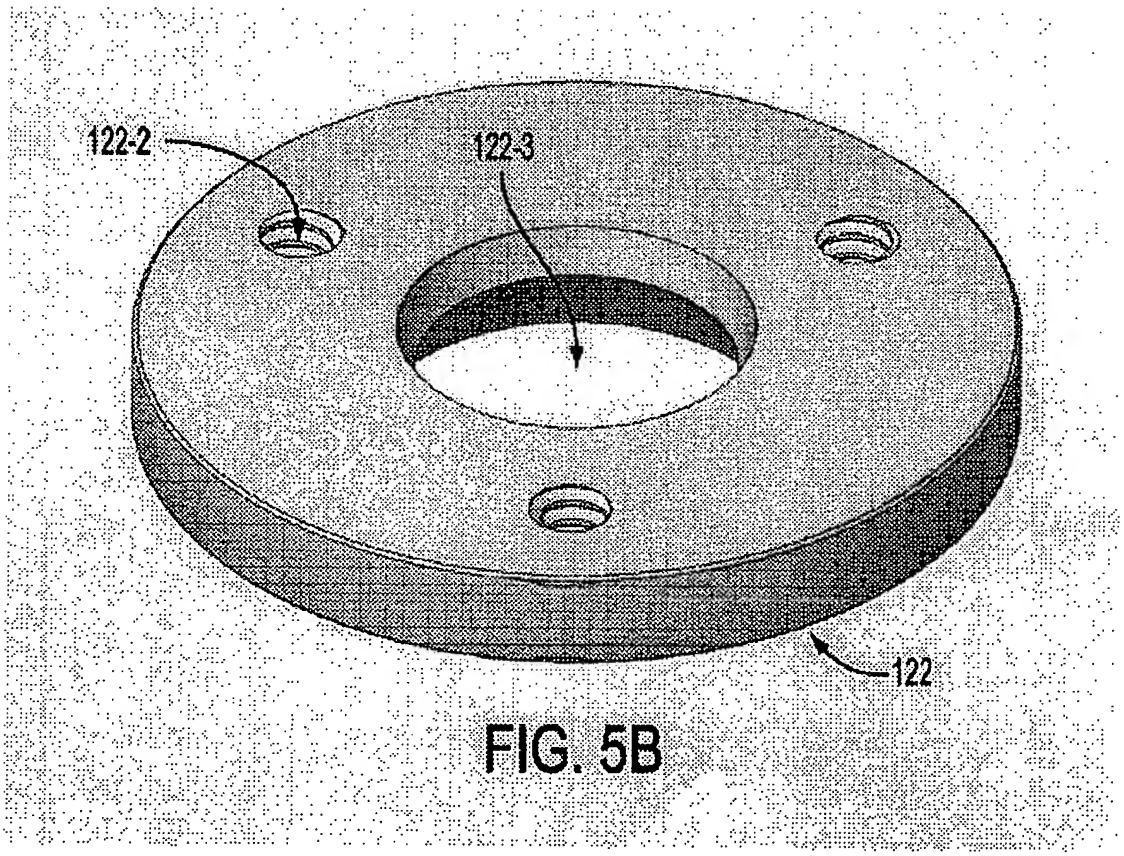


FIG. 5B

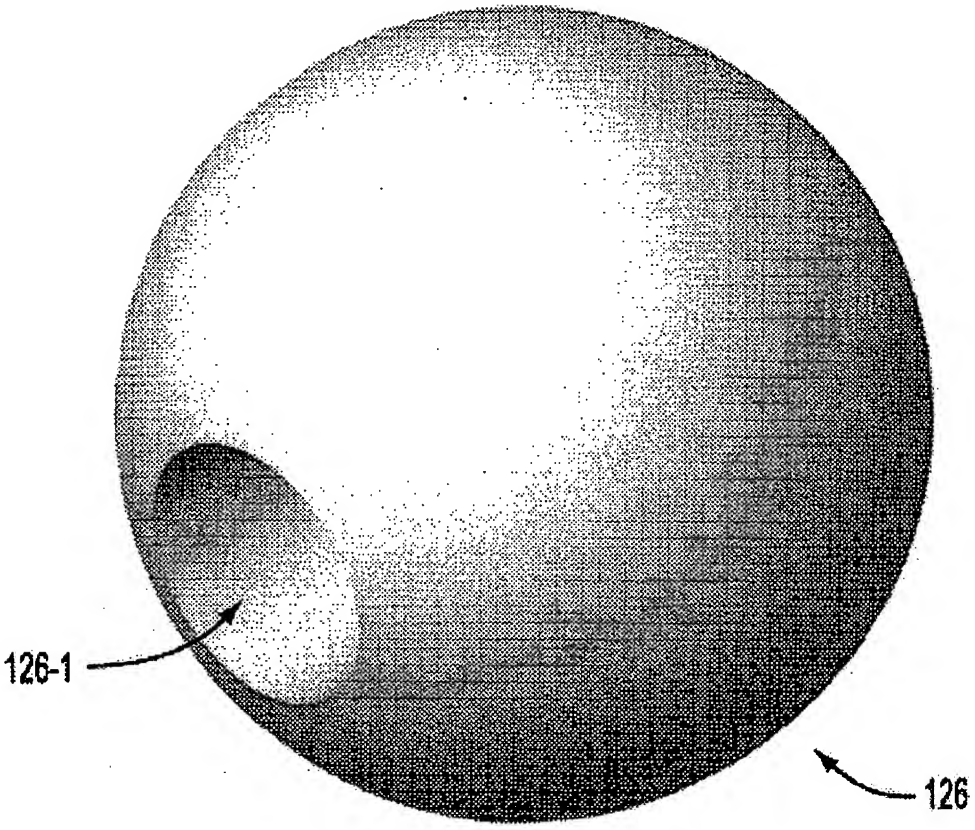
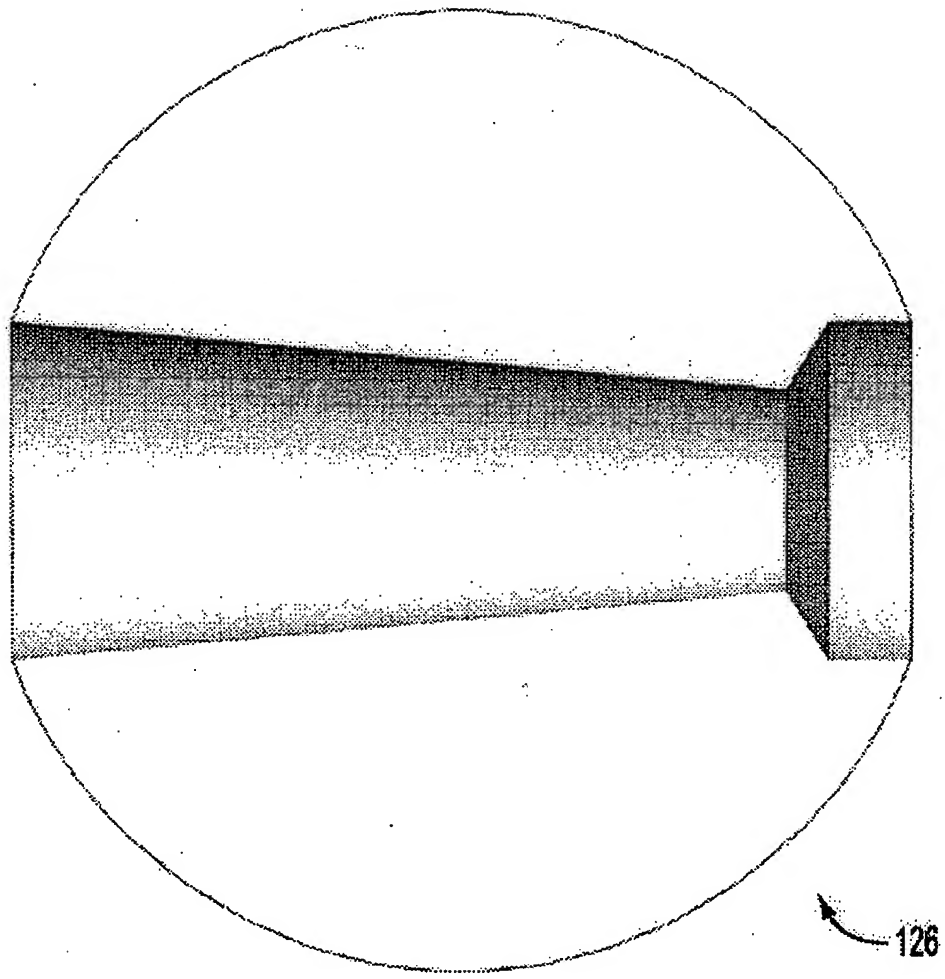


FIG. 6



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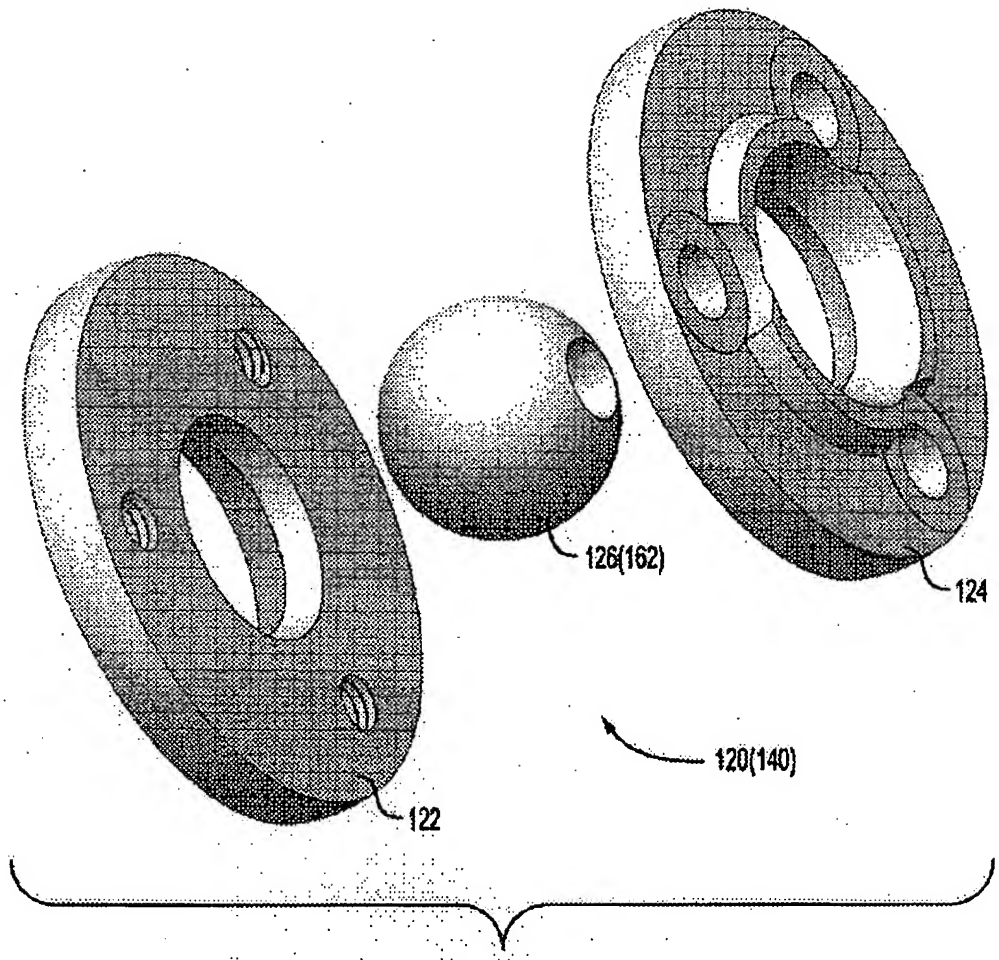


FIG. 8

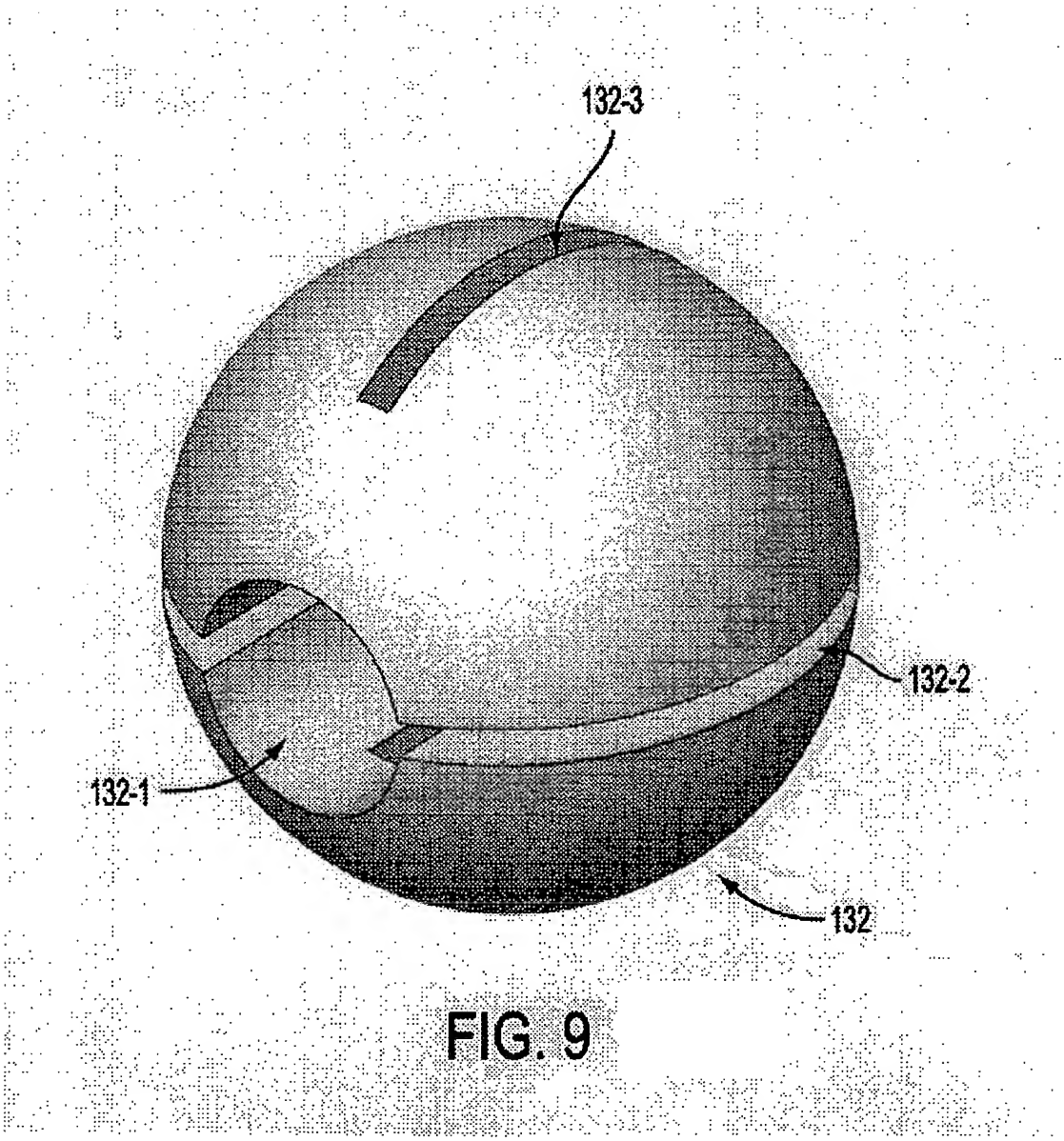


FIG. 9

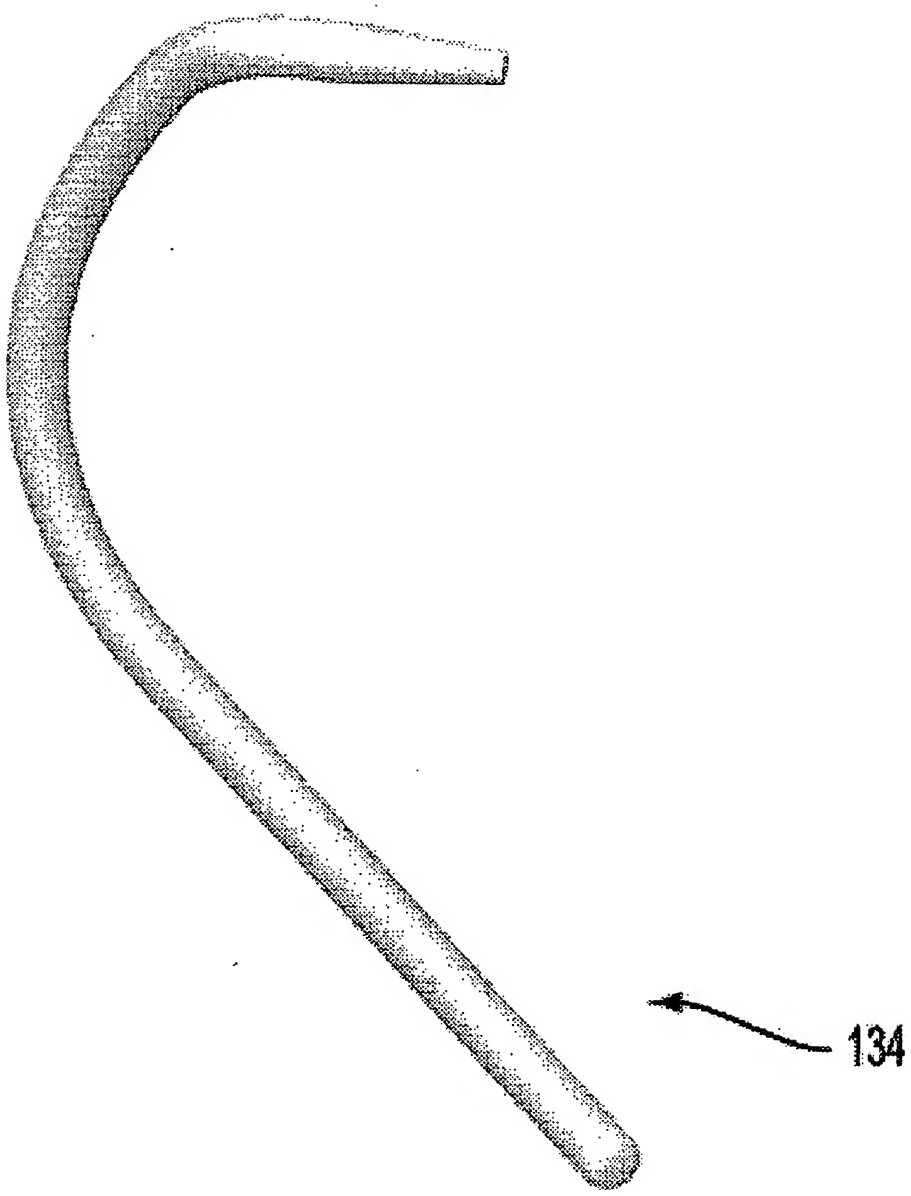


FIG. 10A

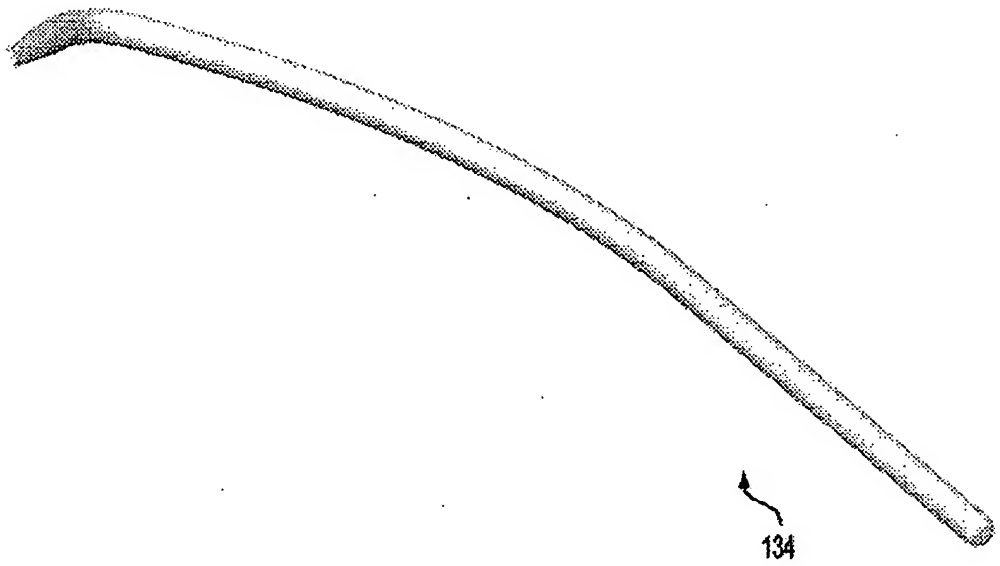


FIG. 10B

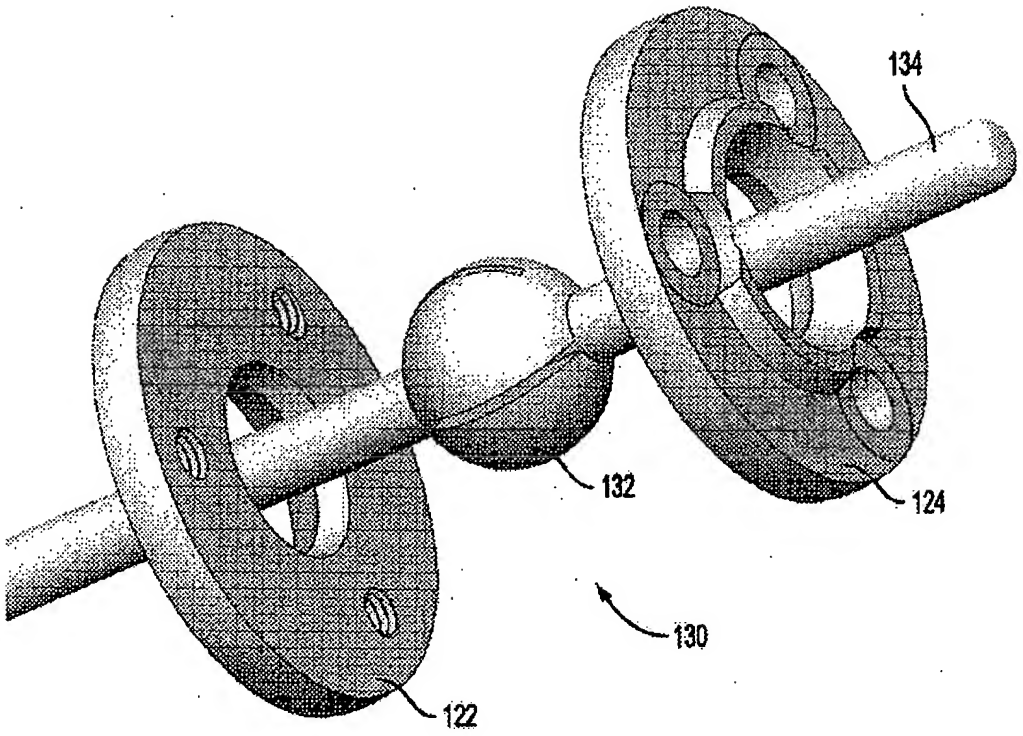
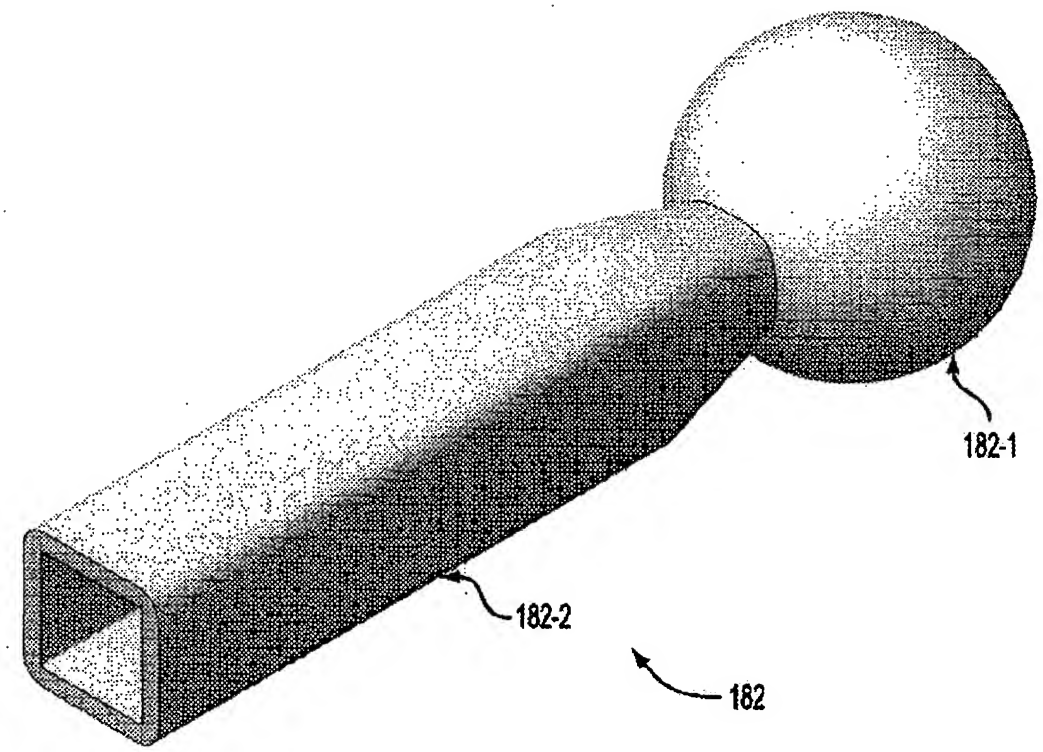


FIG. 11



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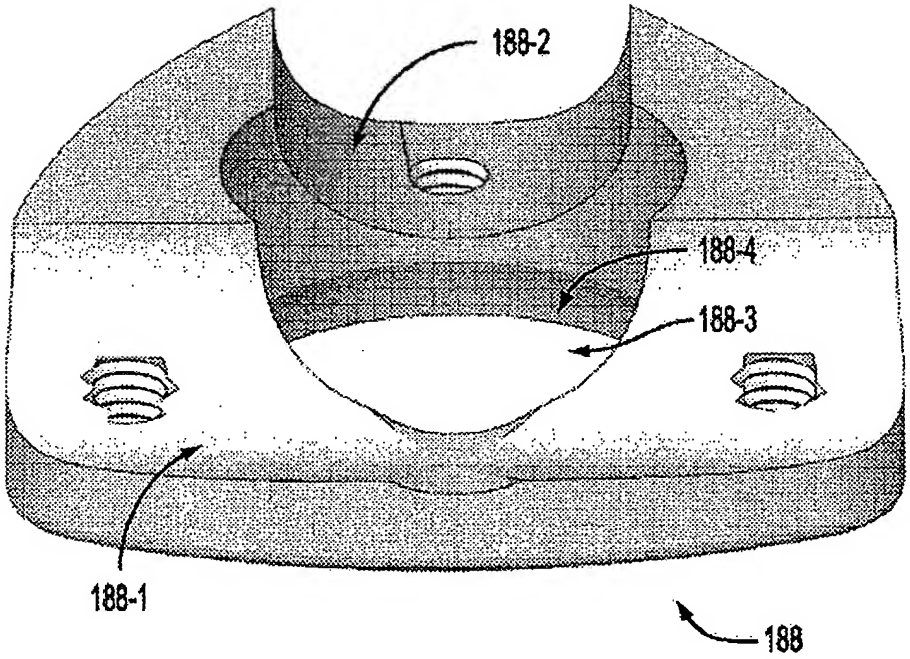
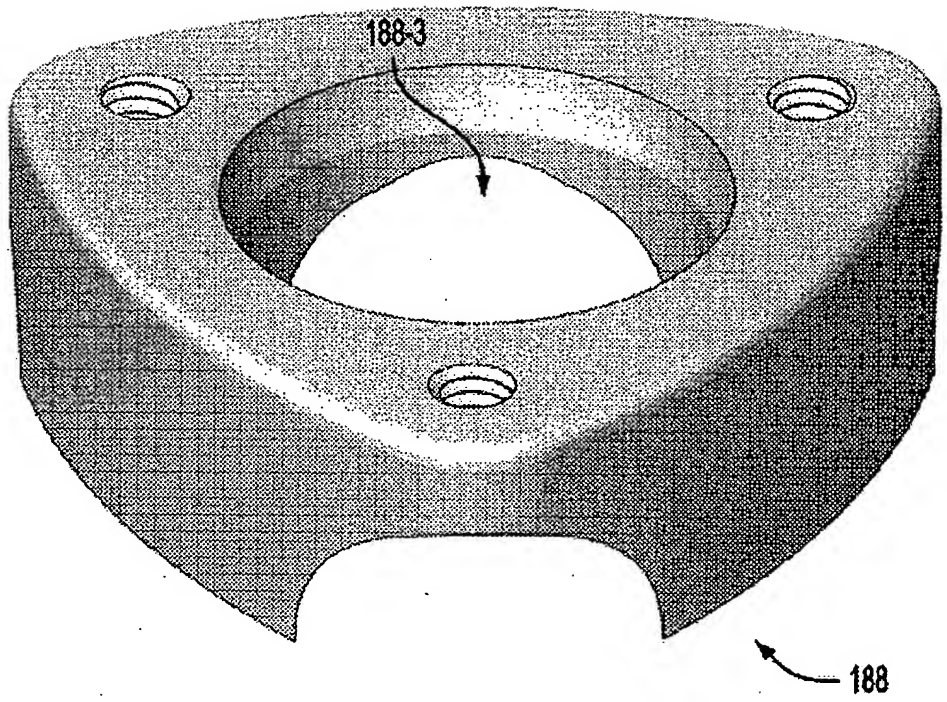


FIG. 13A



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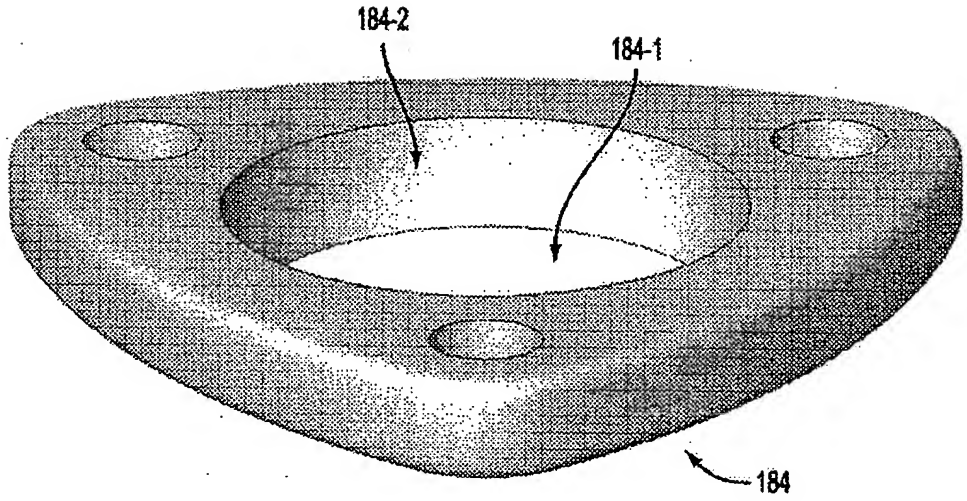

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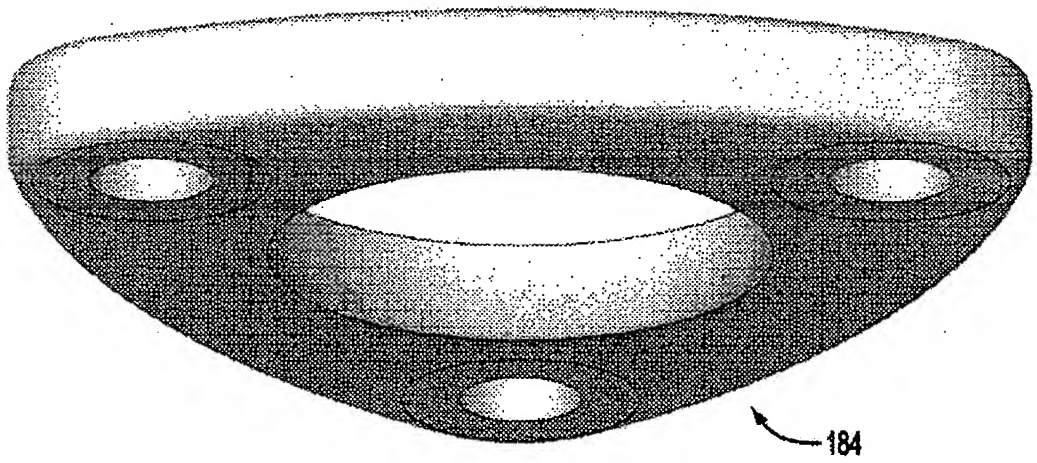

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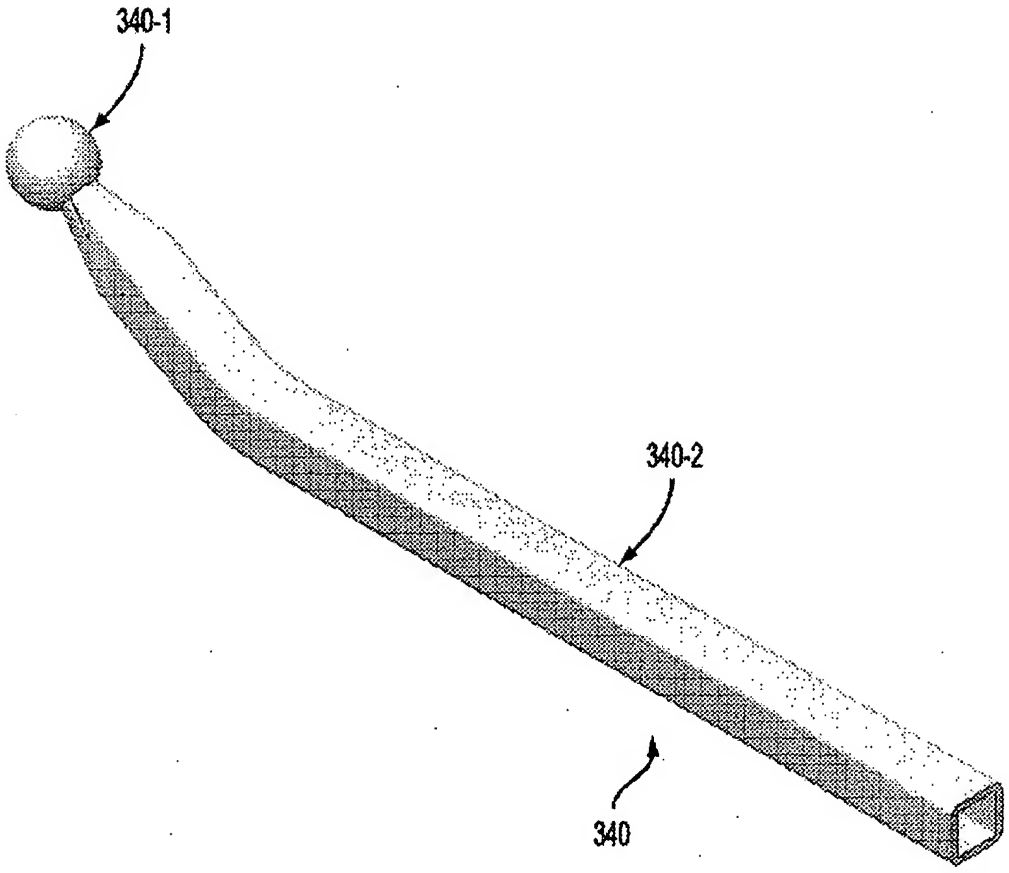

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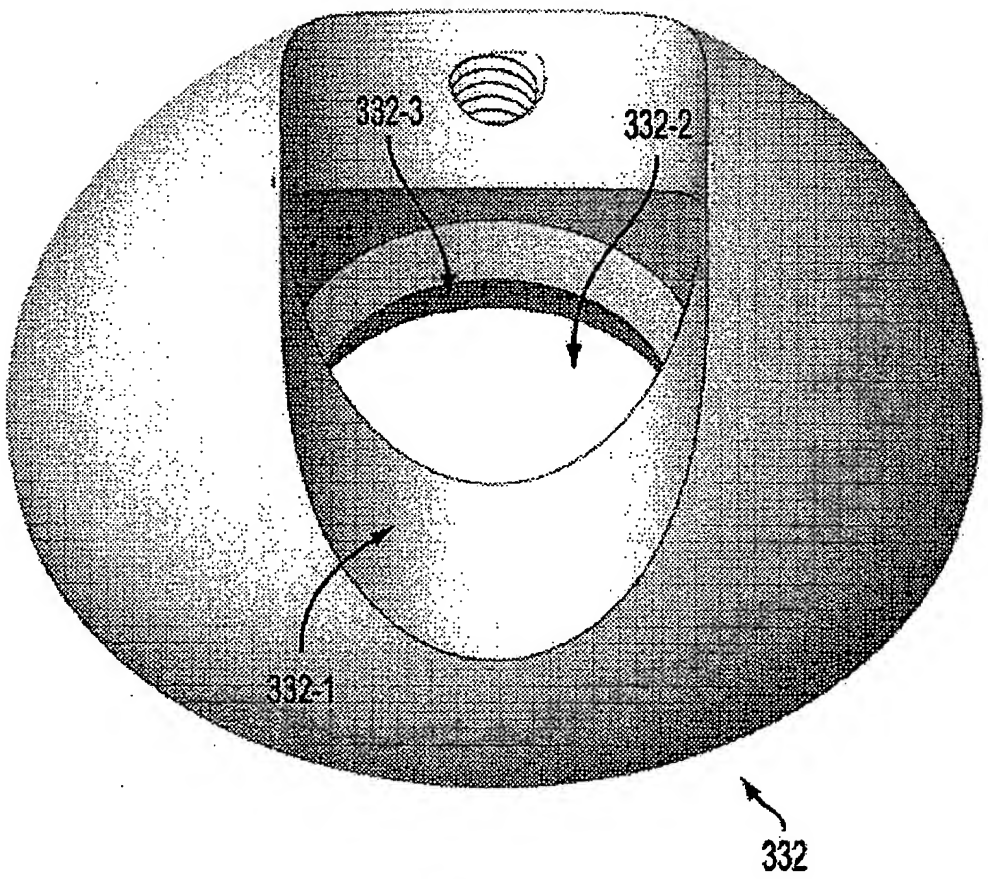

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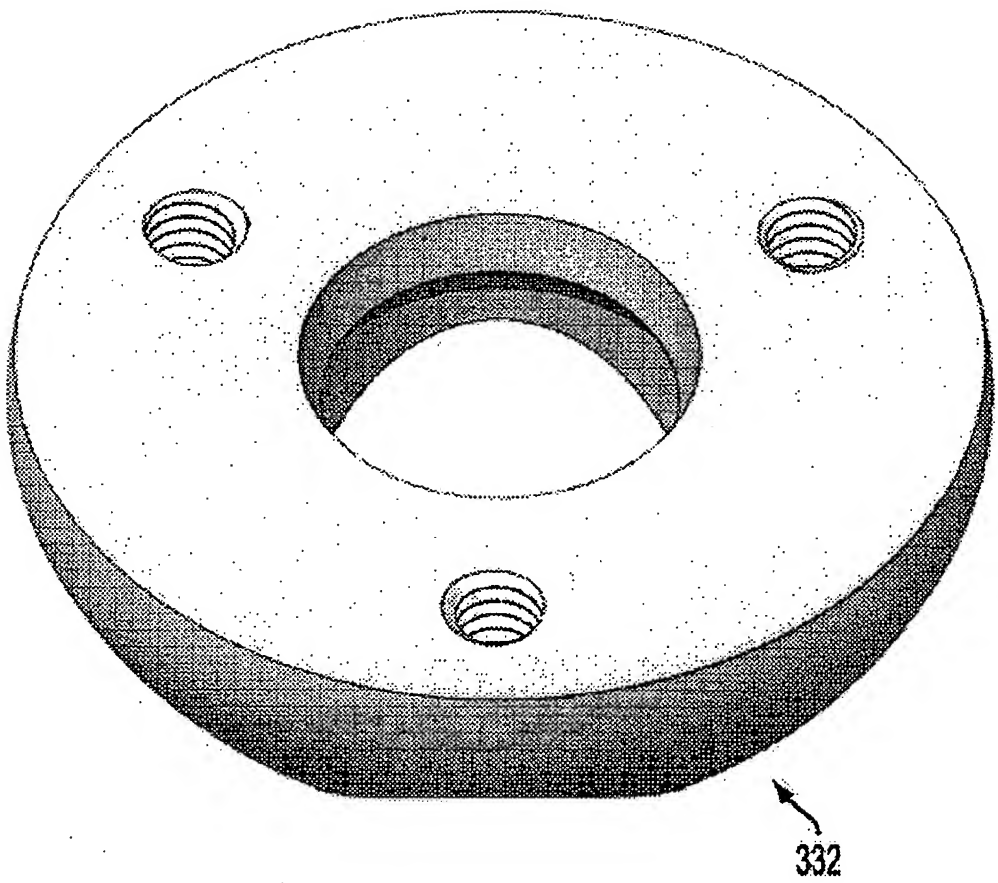

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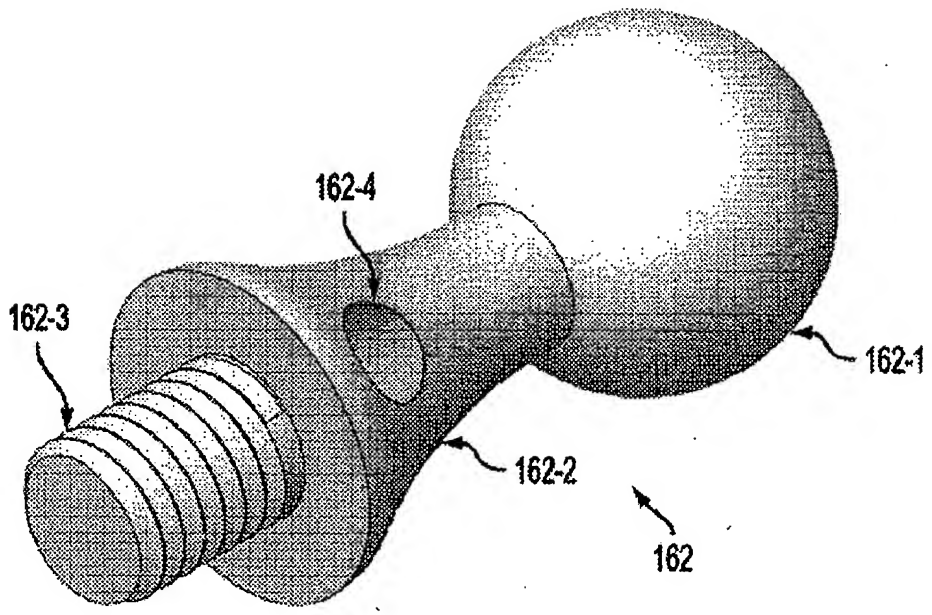

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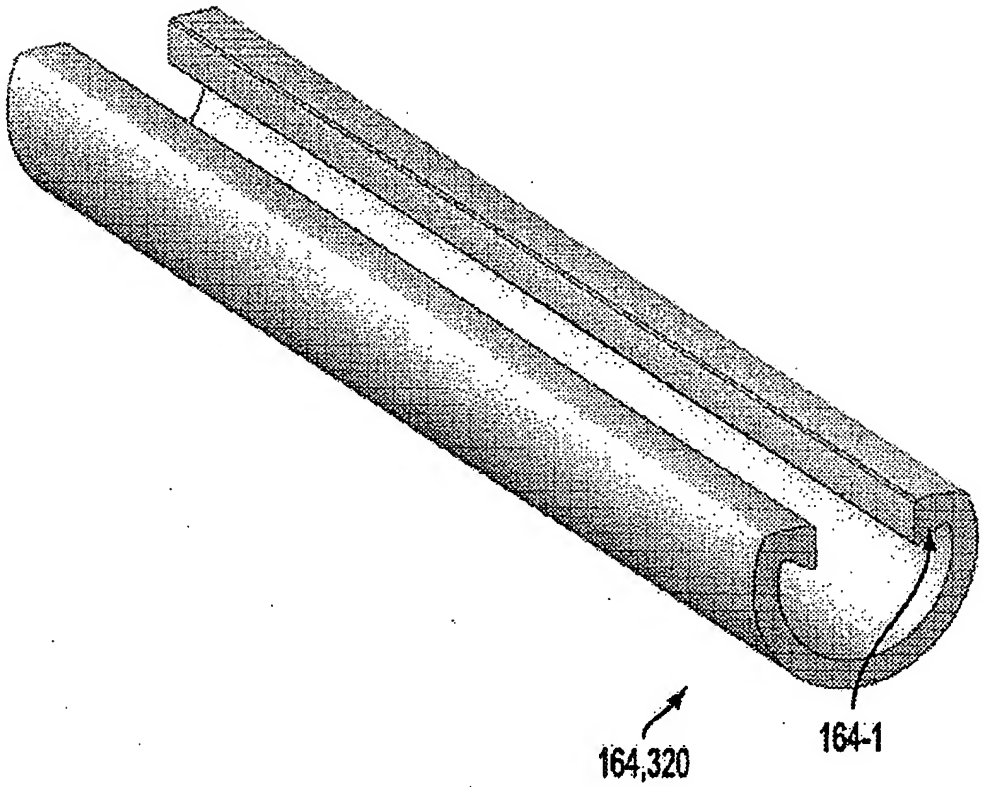
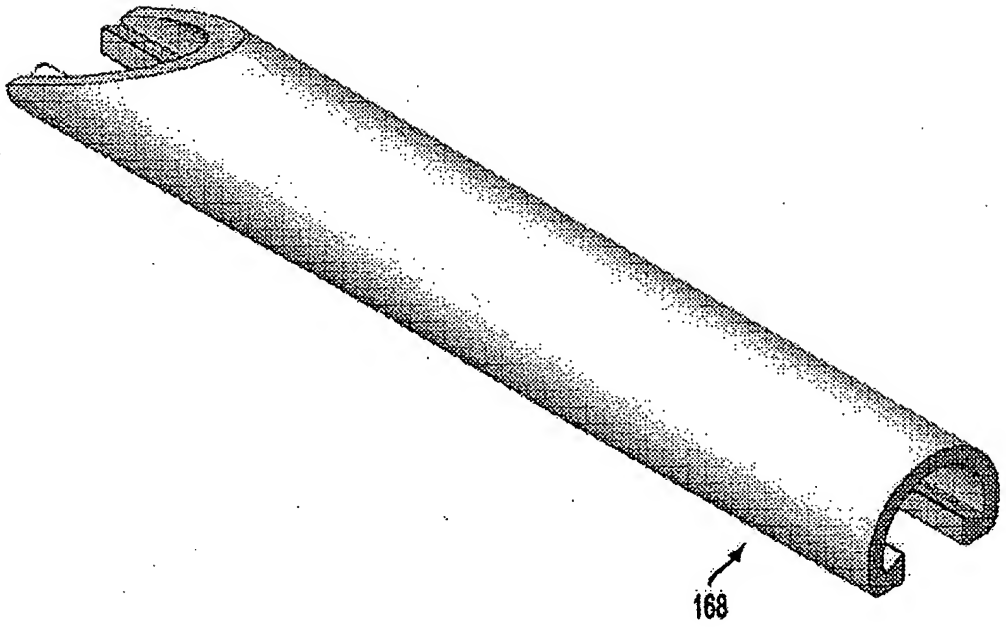


FIG. 18



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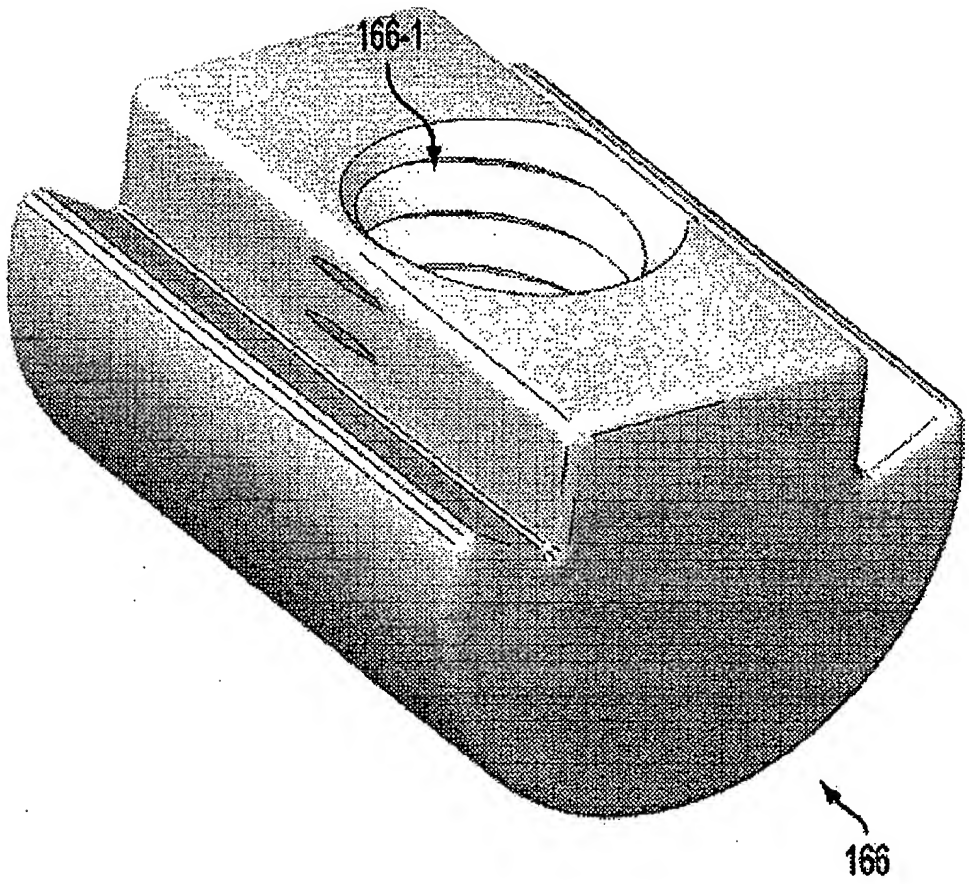


FIG. 20

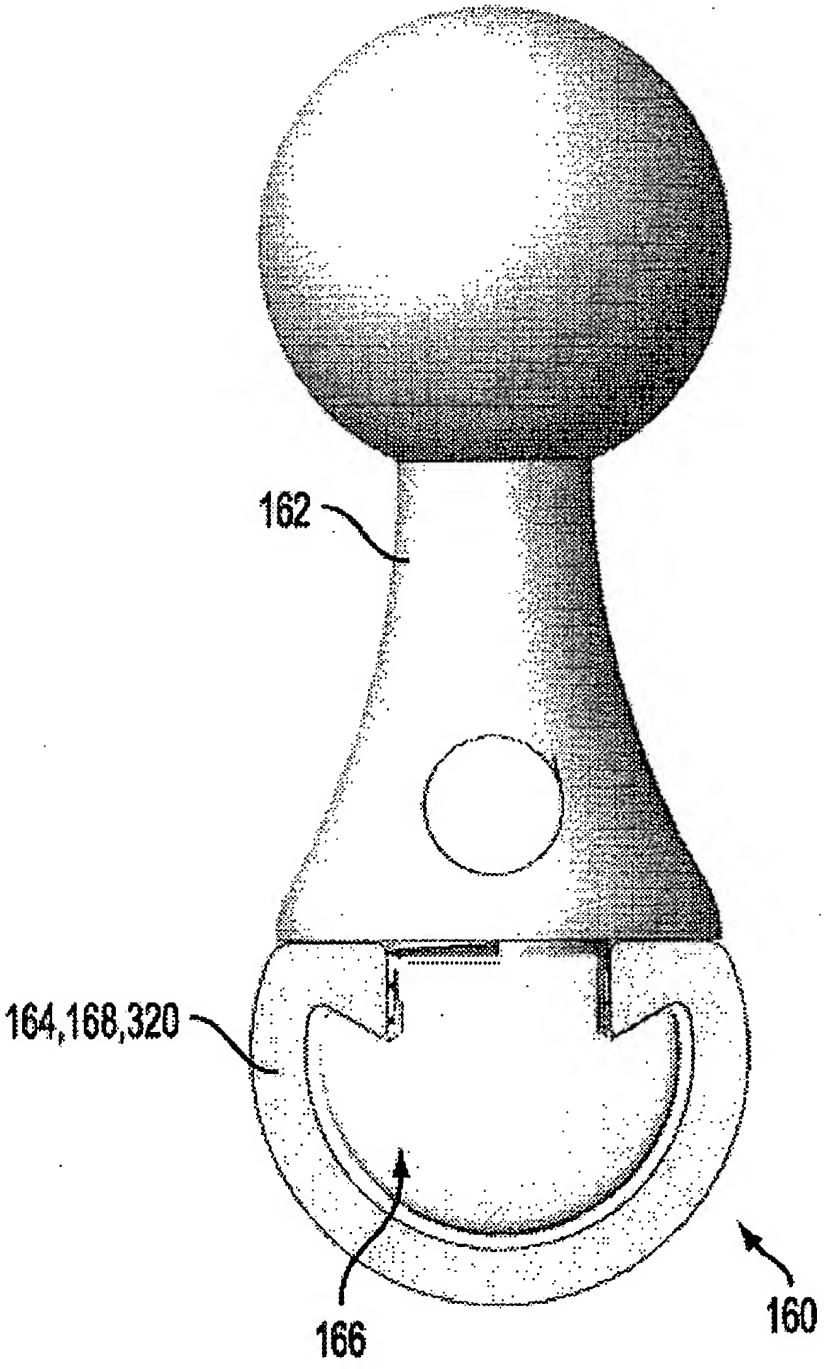


FIG. 21

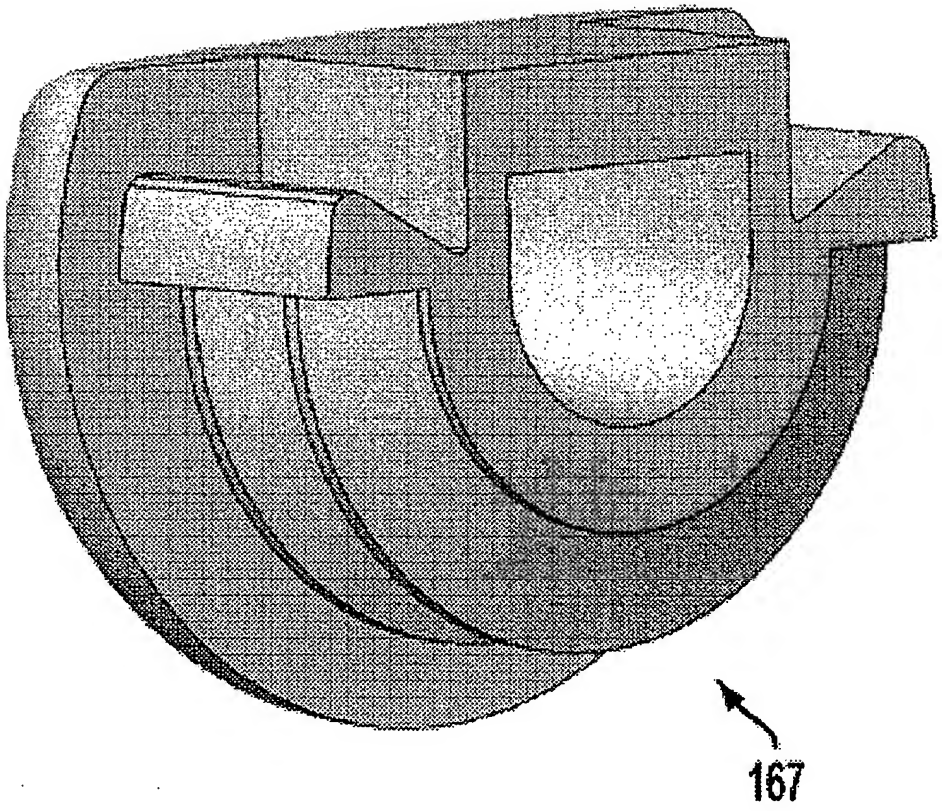
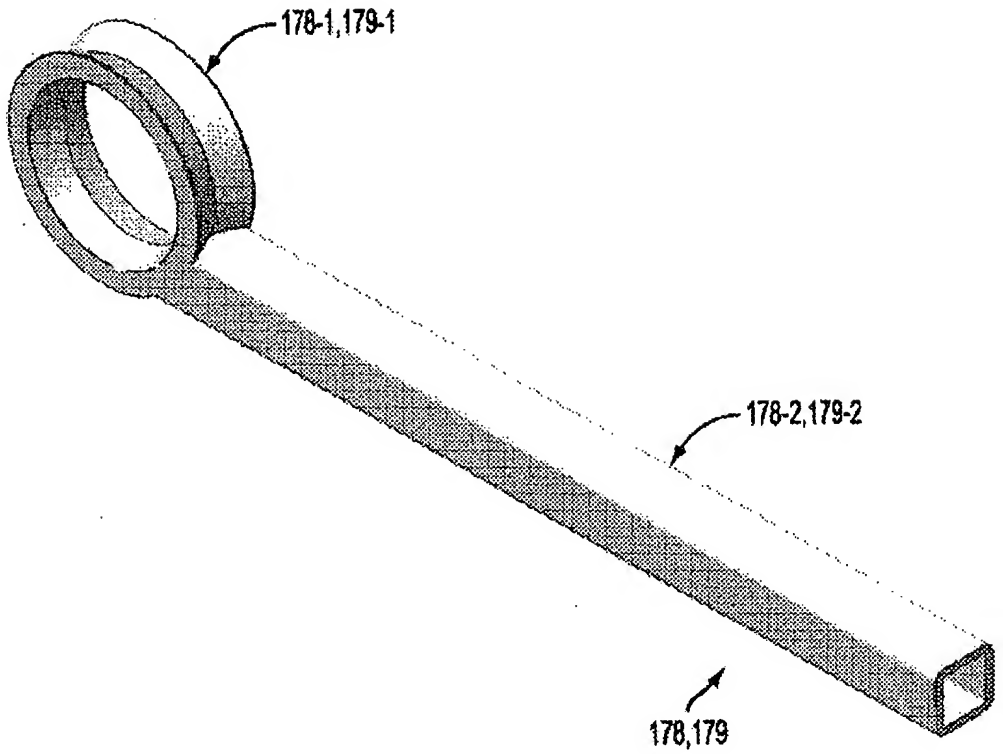


FIG. 22



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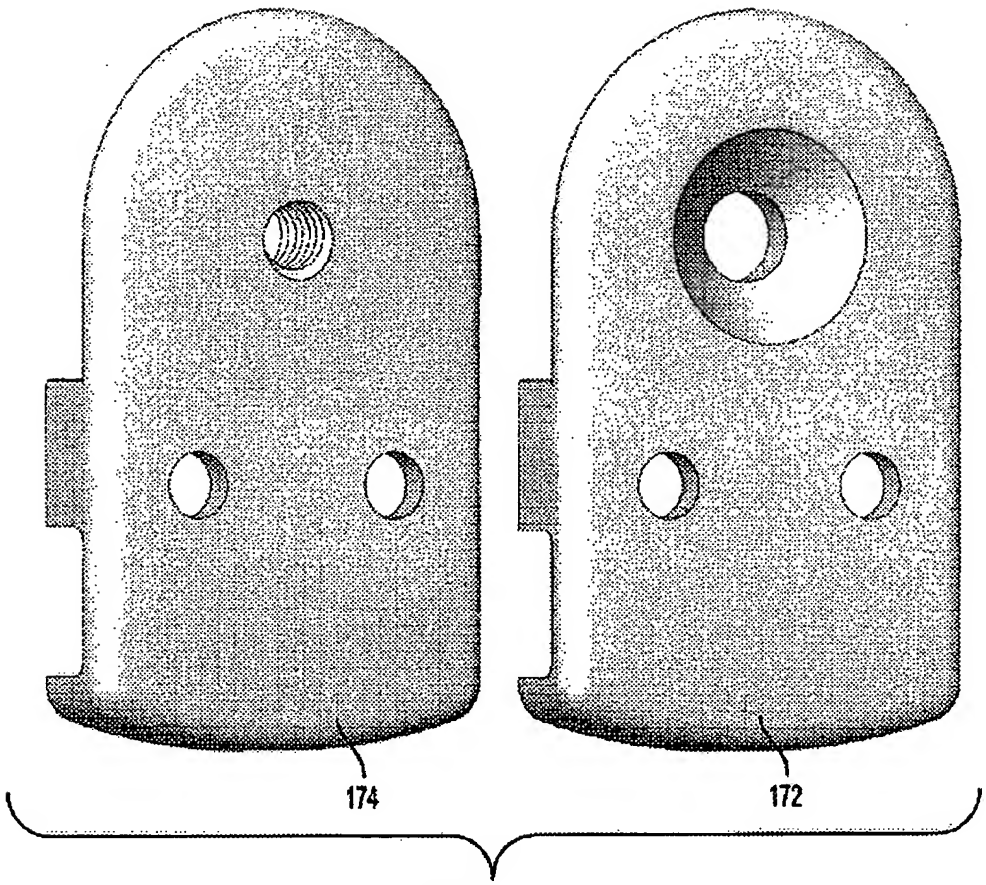

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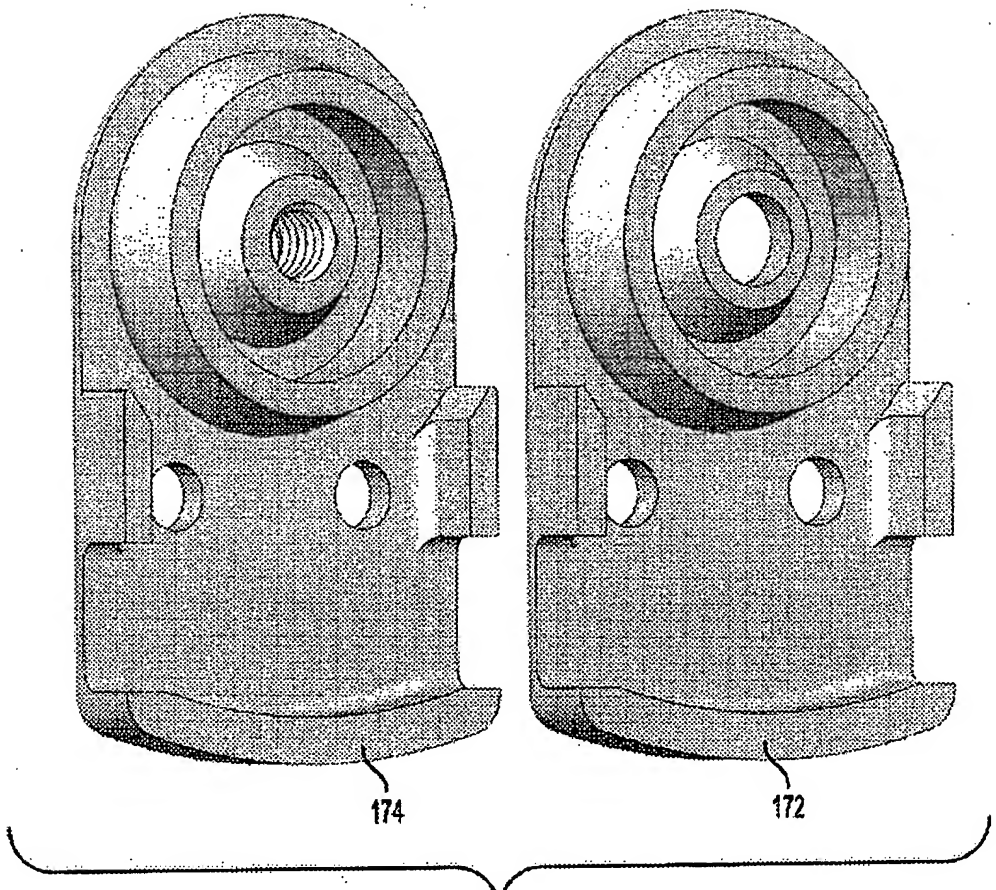
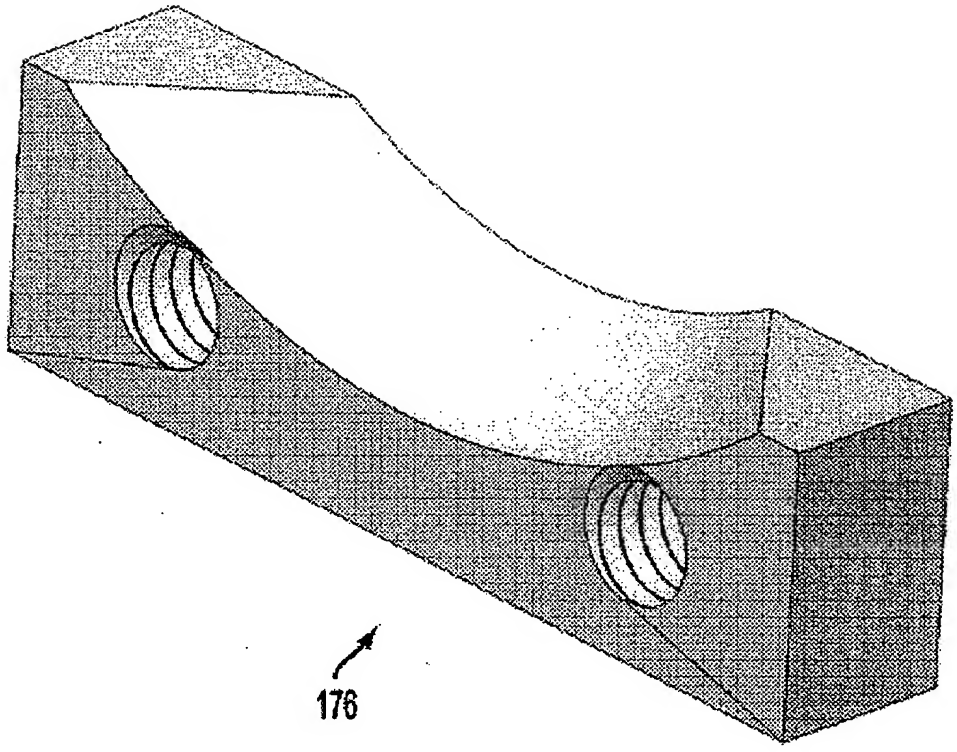


FIG. 24B



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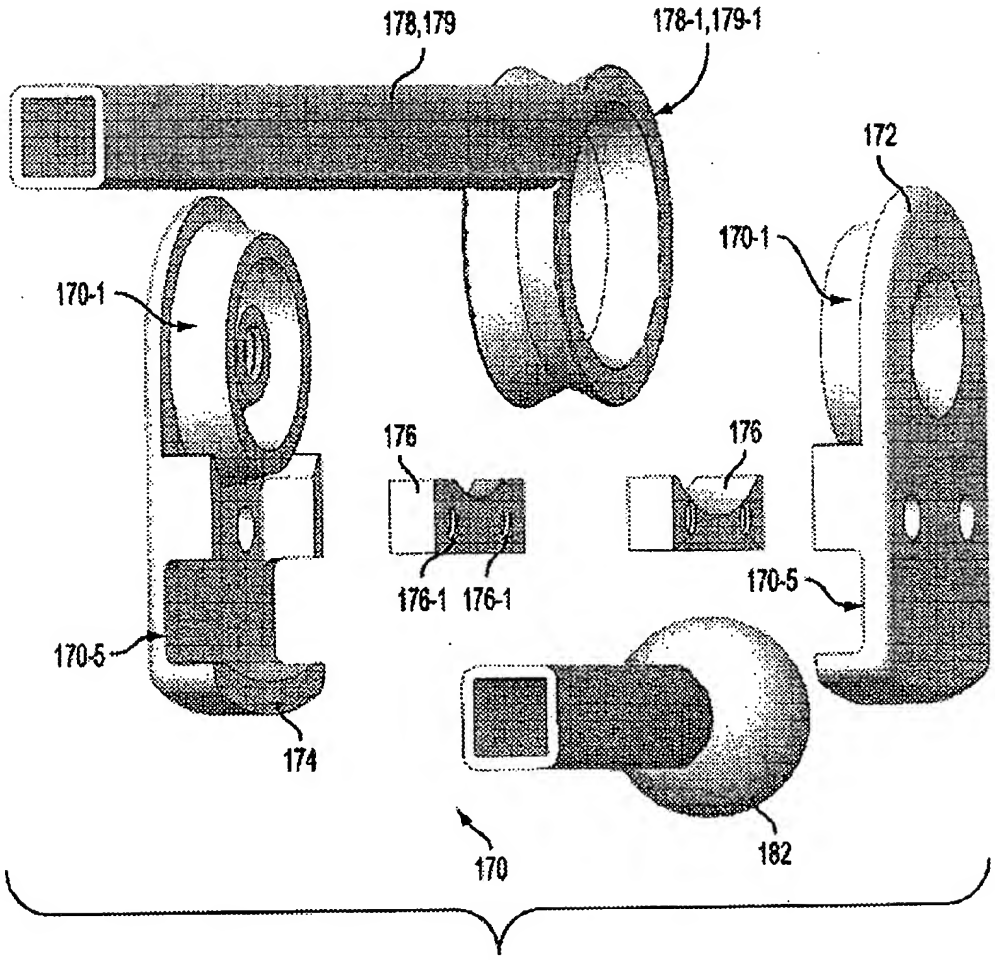
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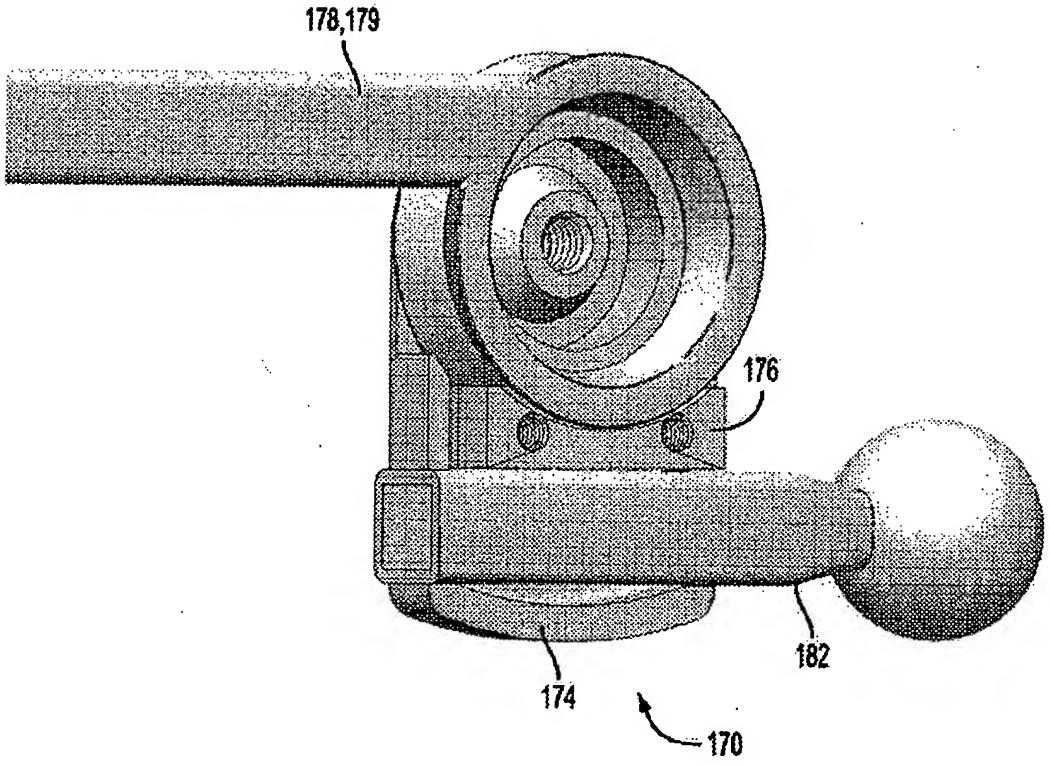
FIG. 26



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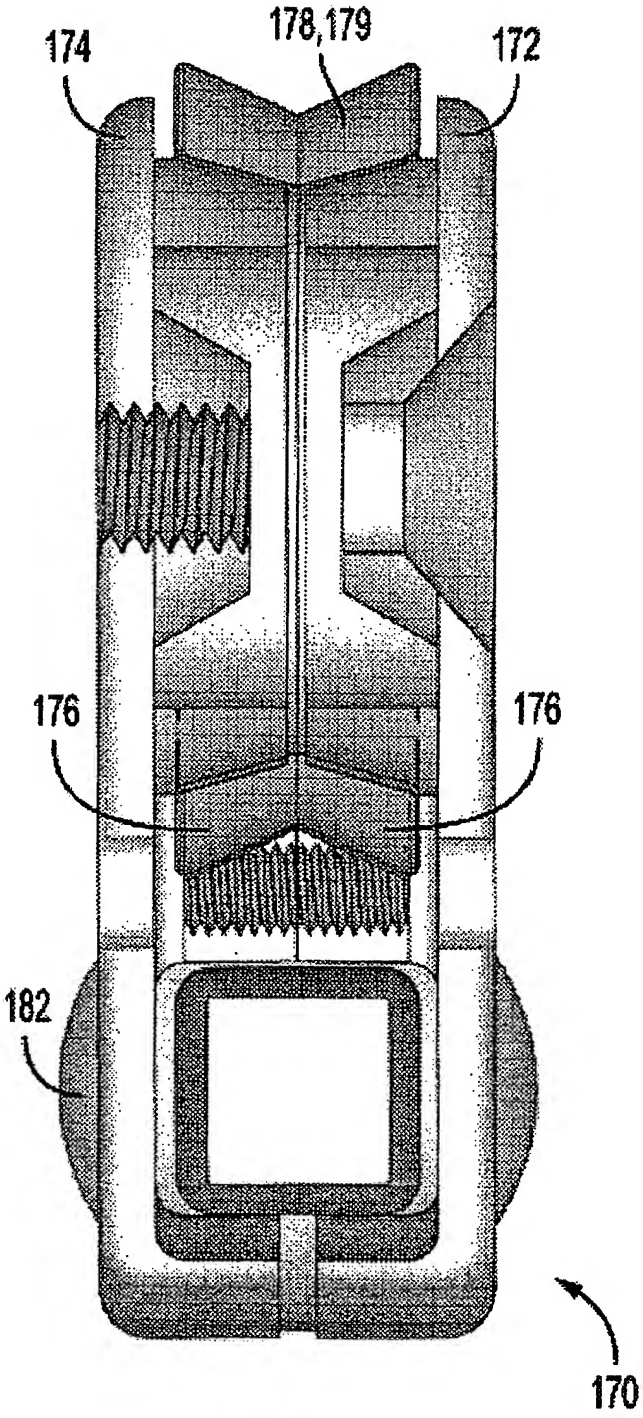
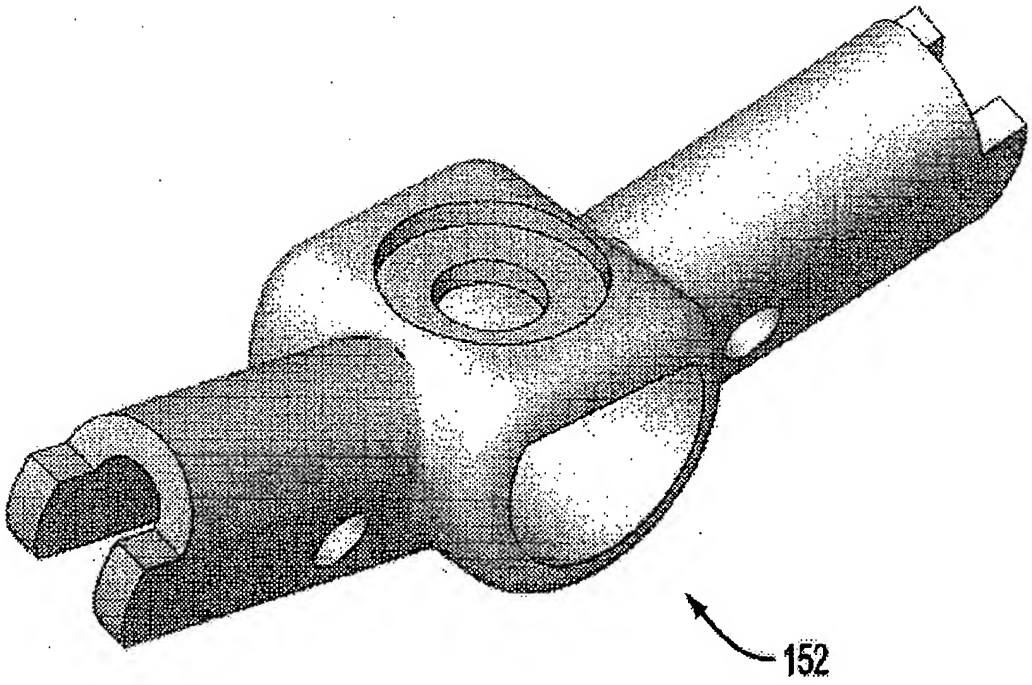


FIG. 28



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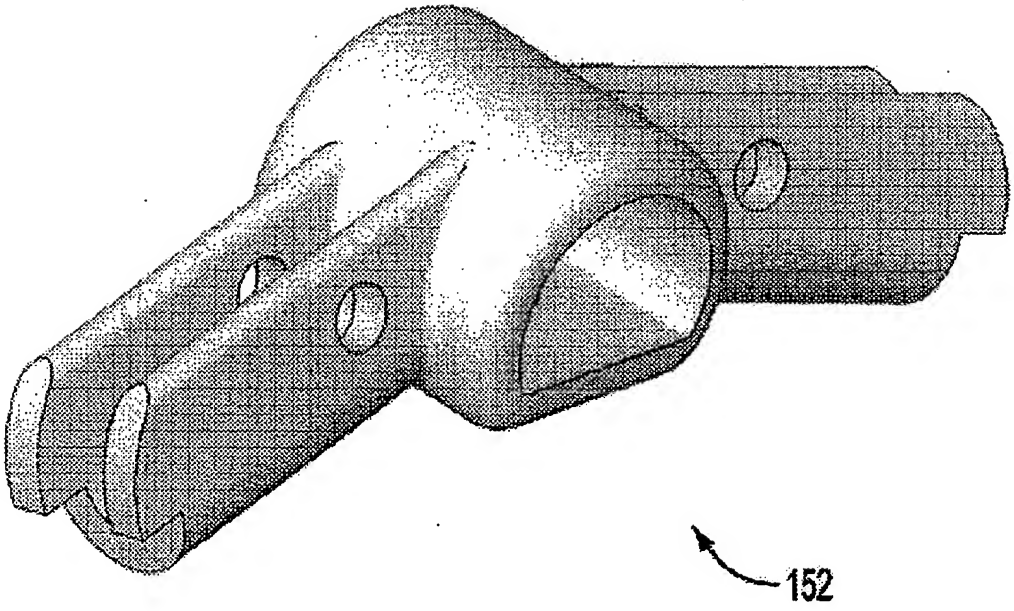

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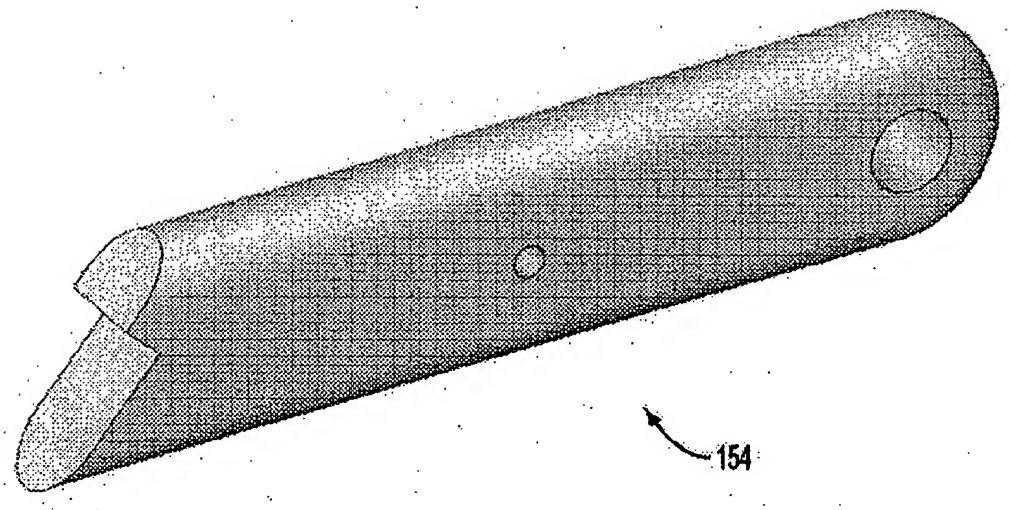

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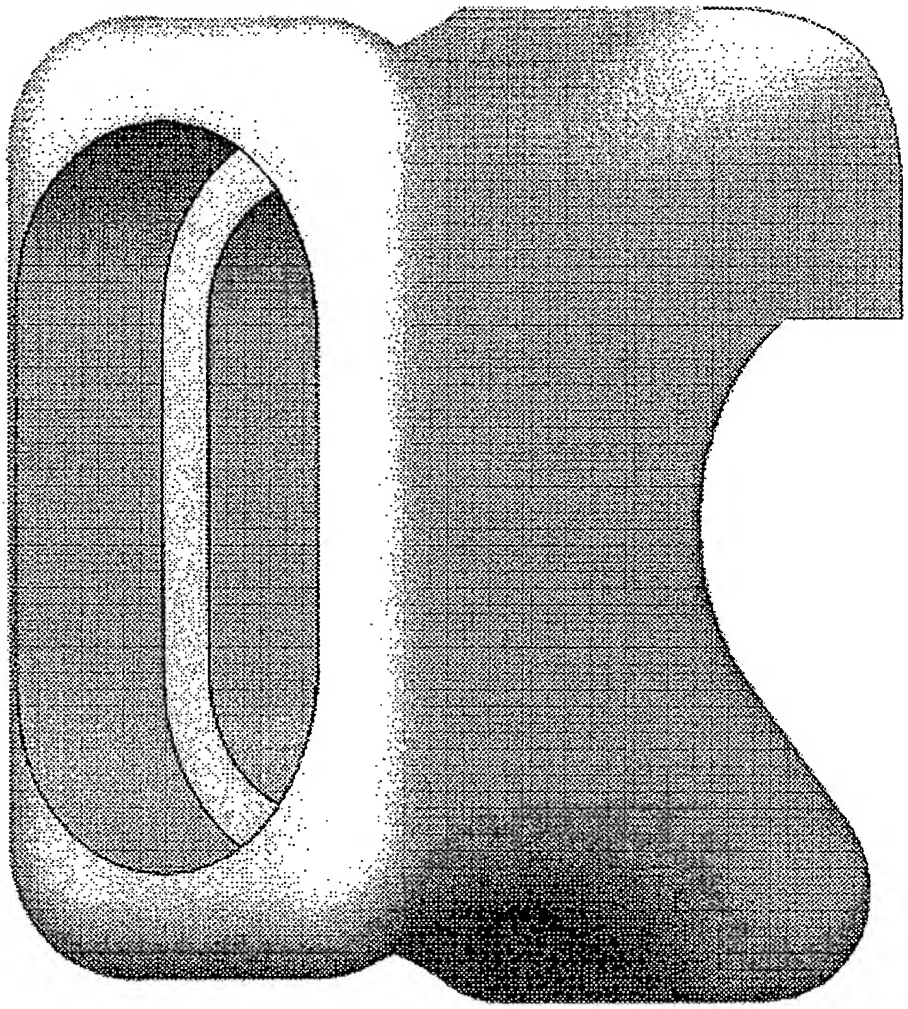

FIG. 31A

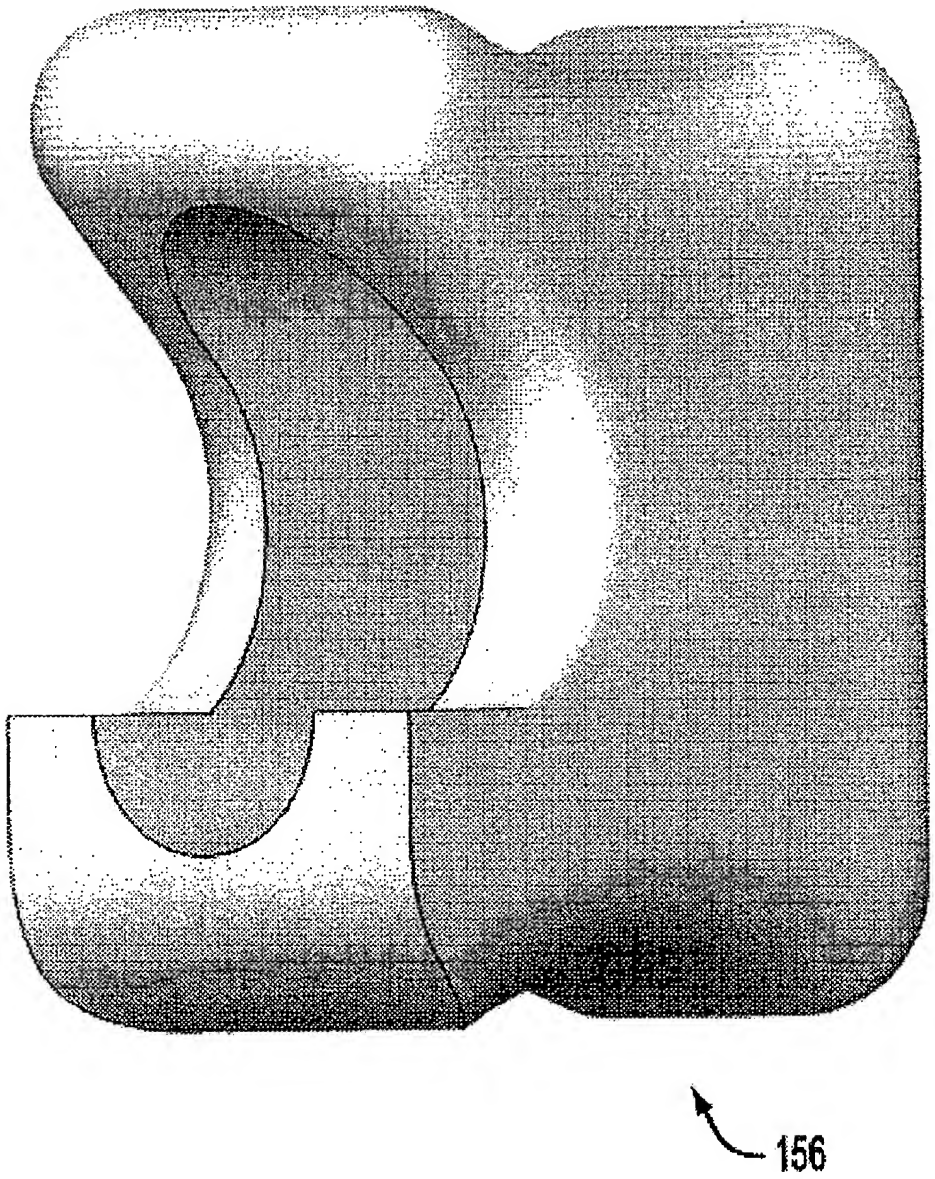

FIG. 31B

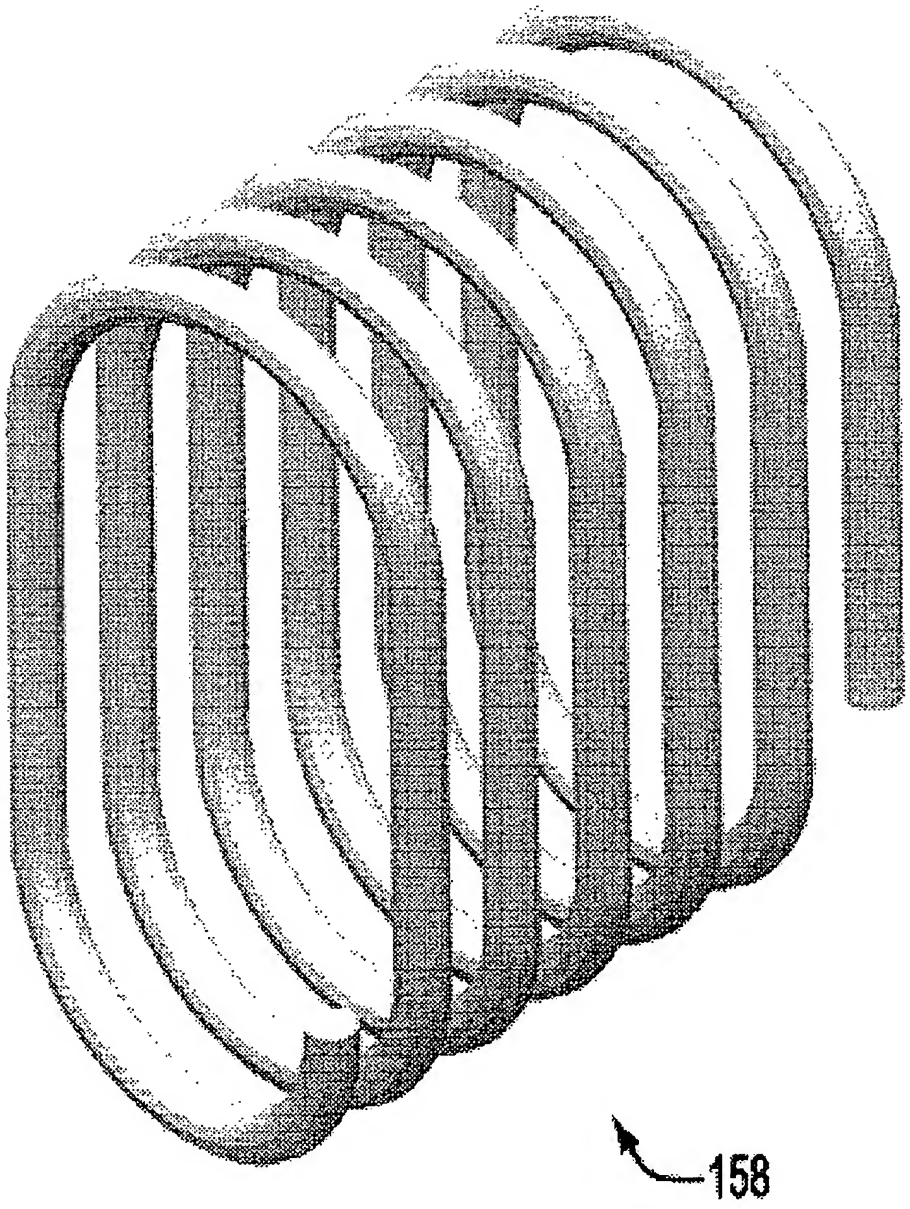

FIG. 32

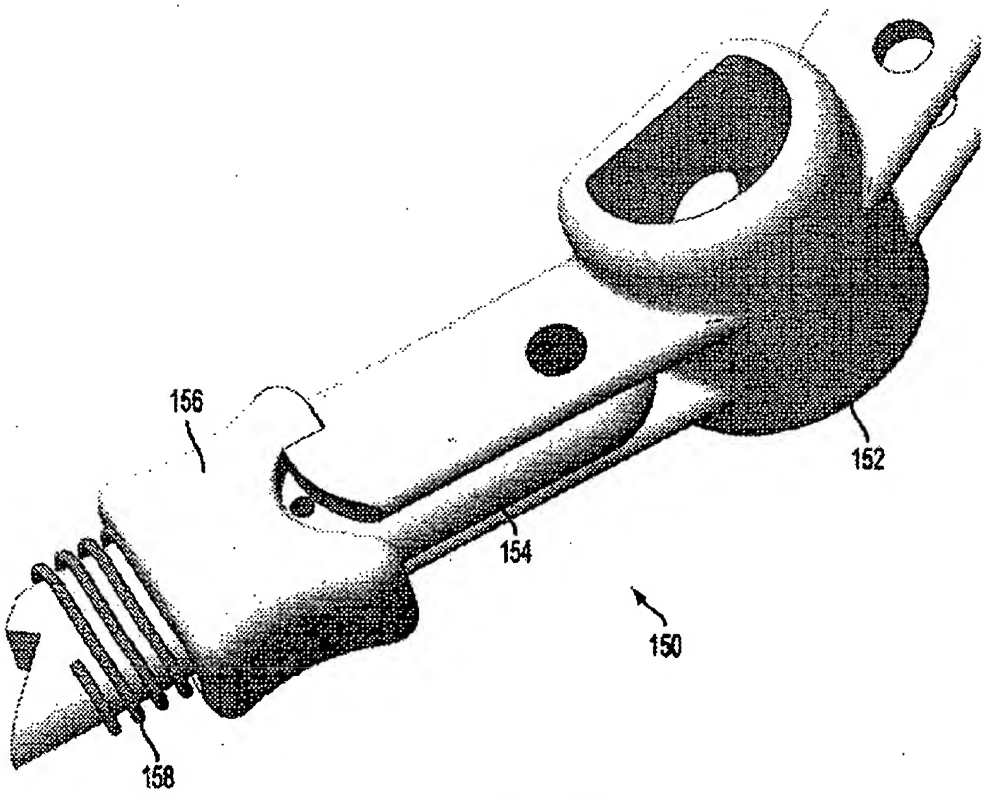

FIG. 33

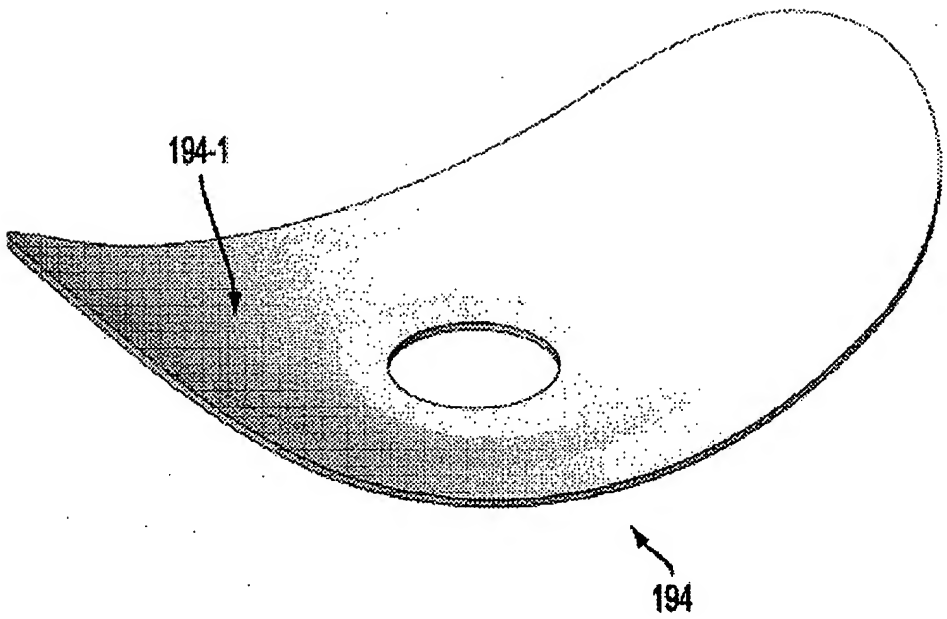

FIG. 34A

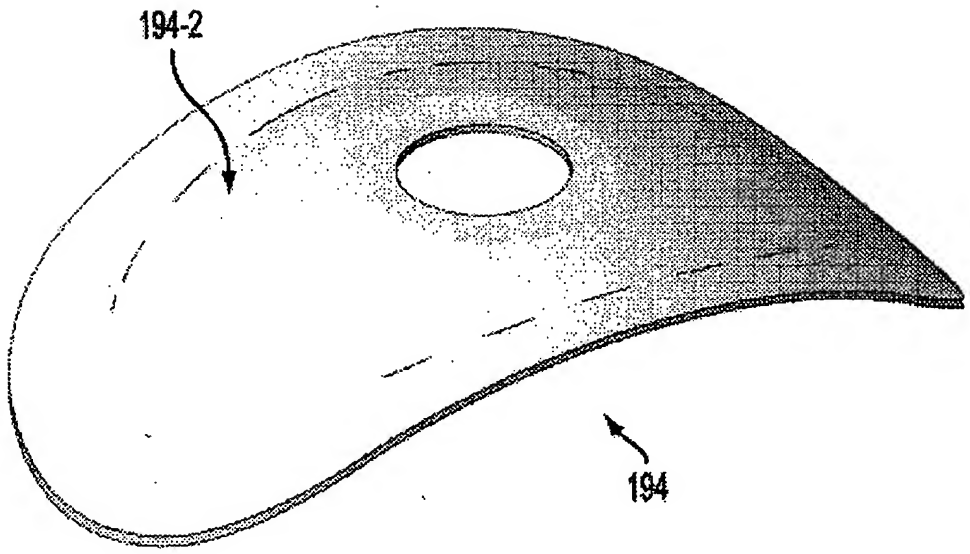

FIG. 34B

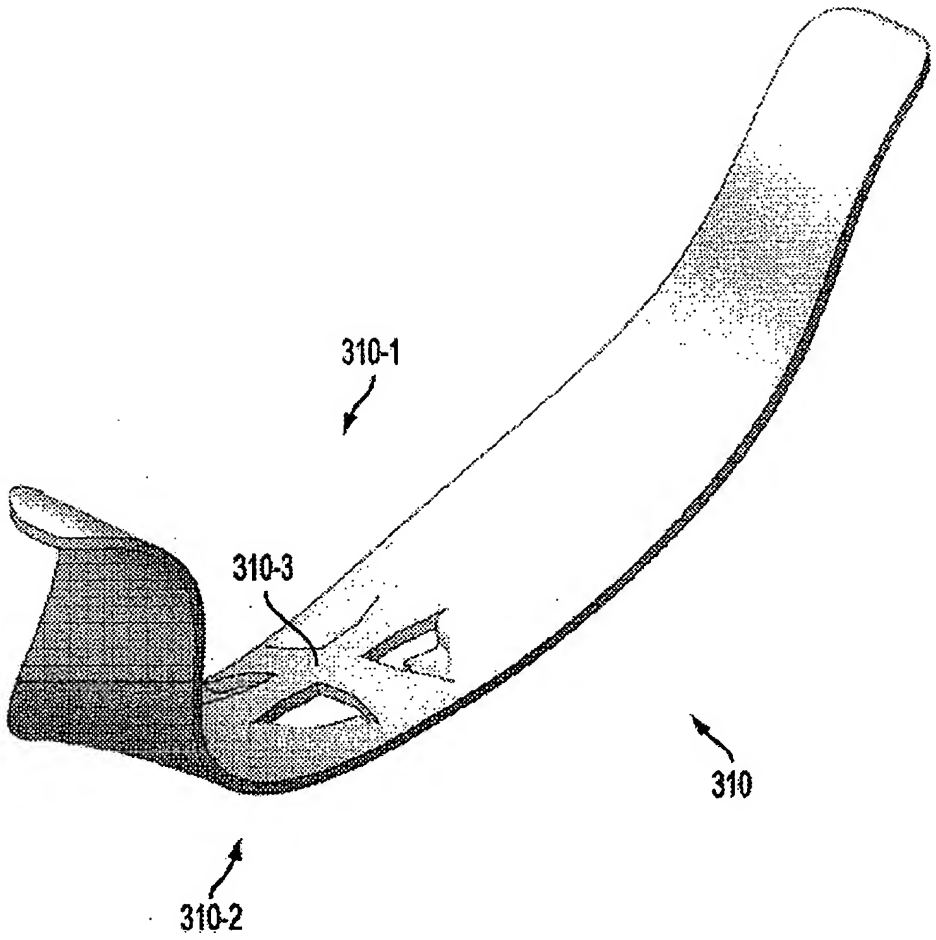

FIG. 35A

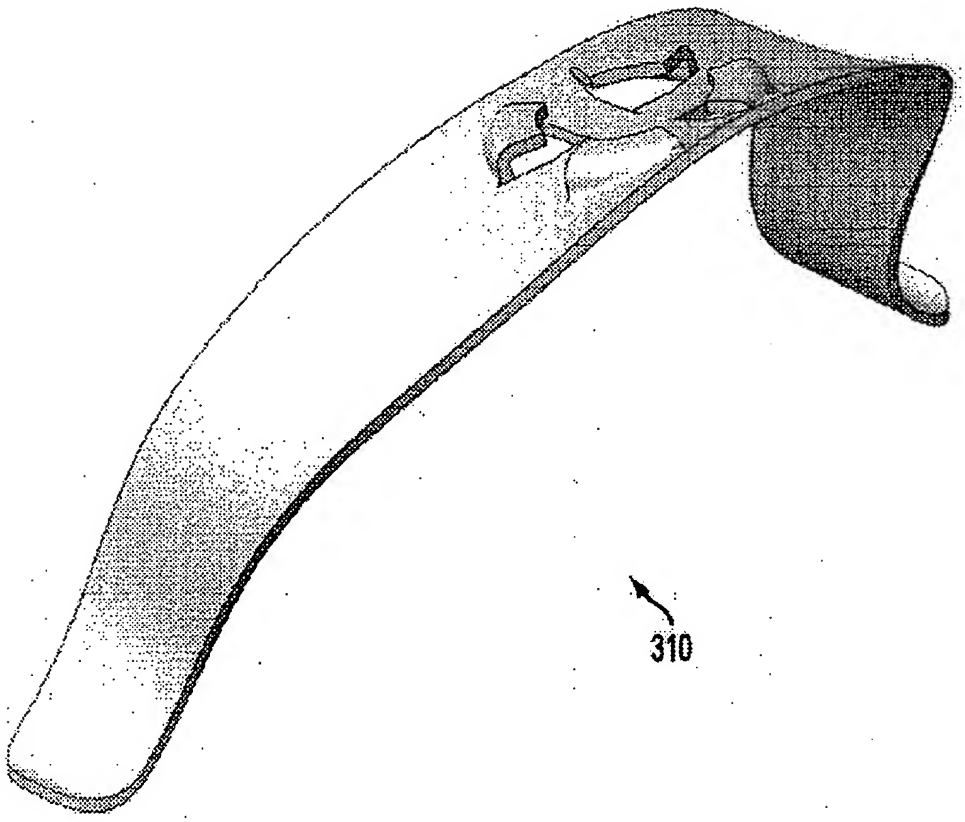

FIG. 35B

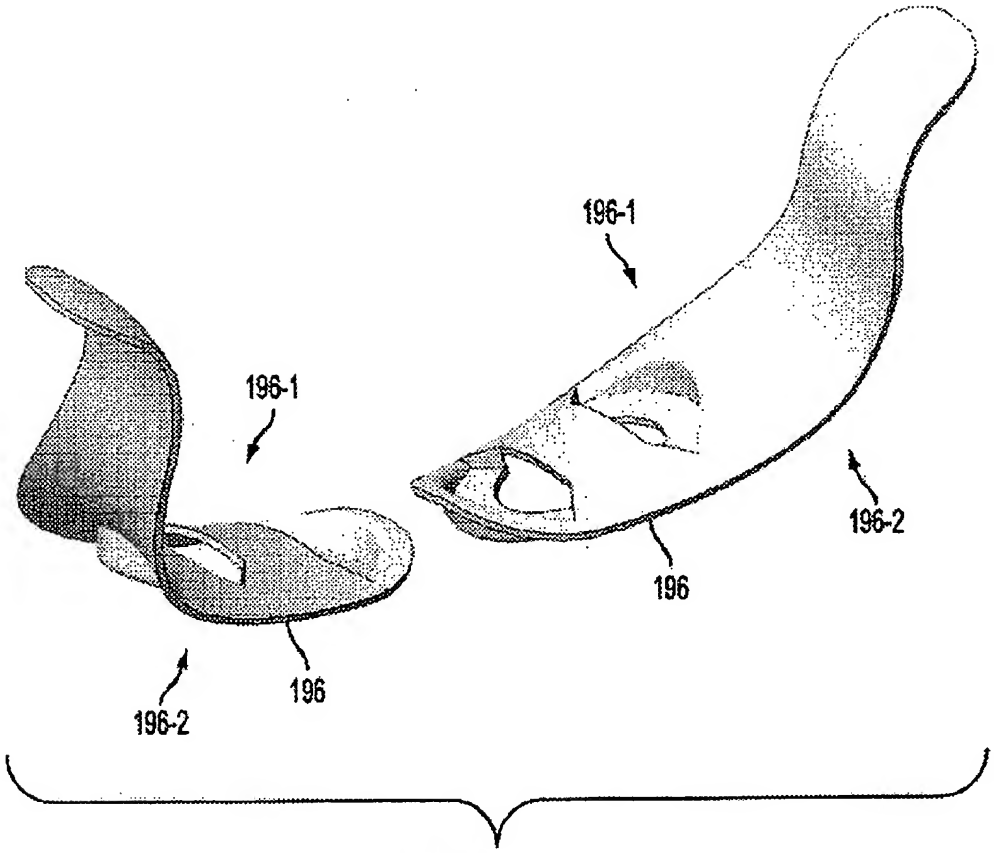

FIG. 36A

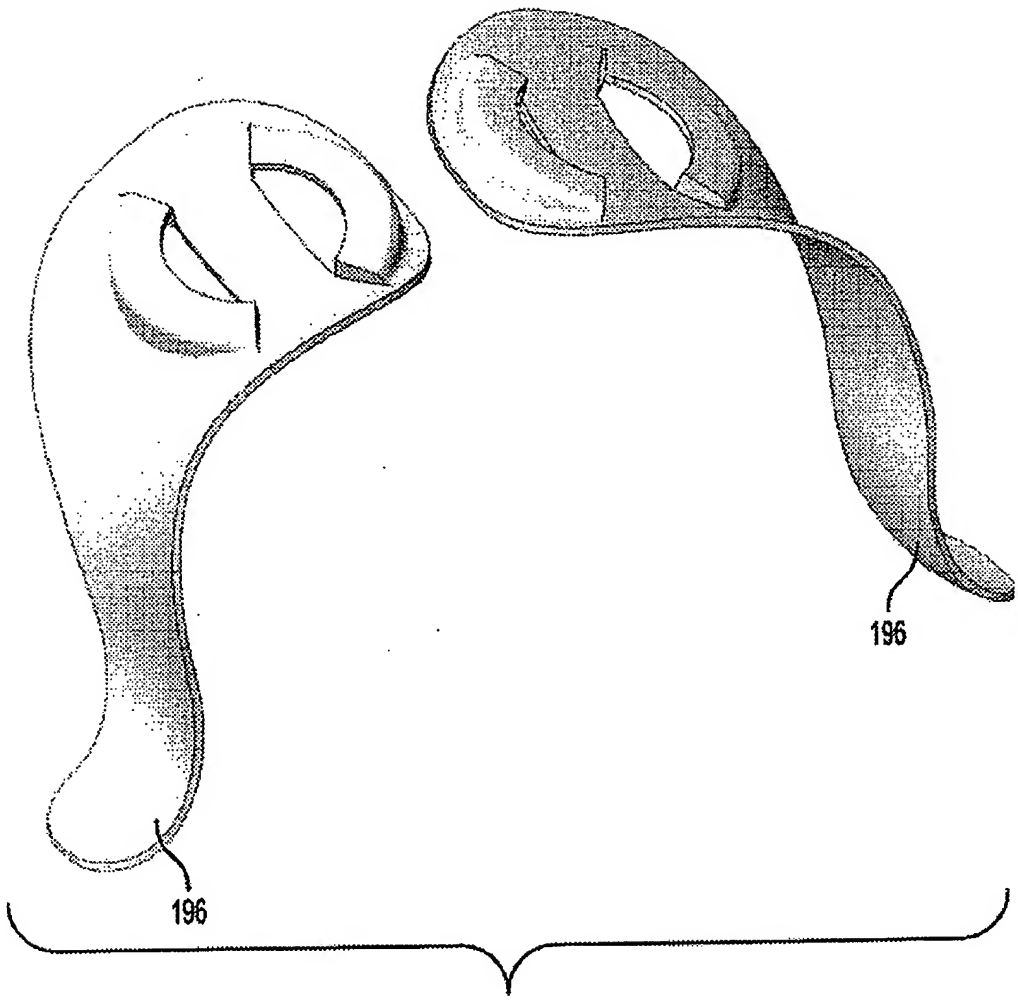

FIG. 36B

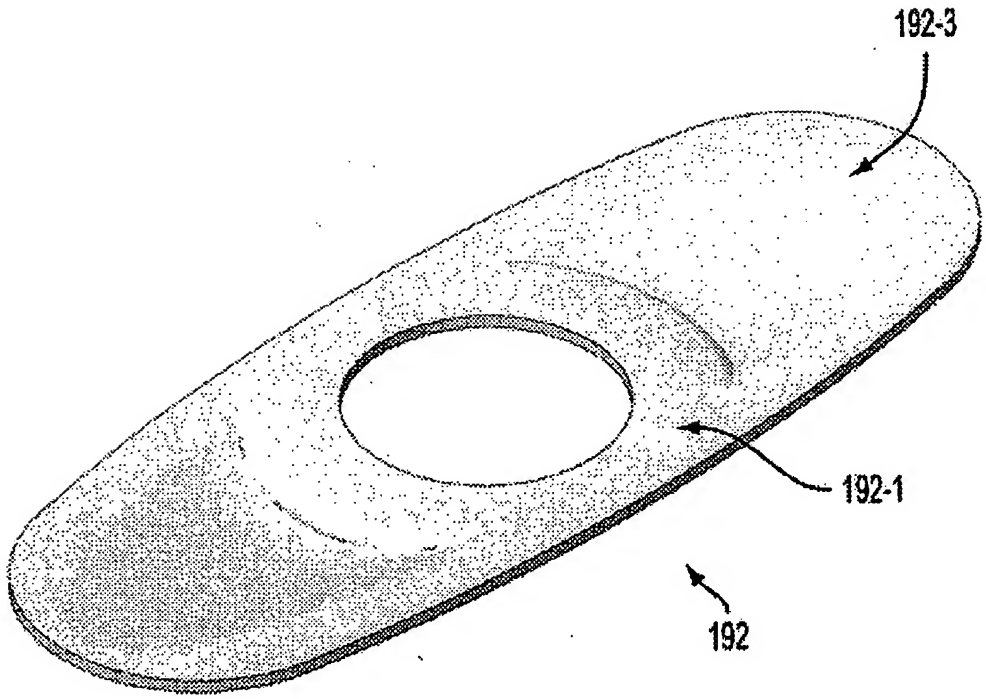

FIG. 37A

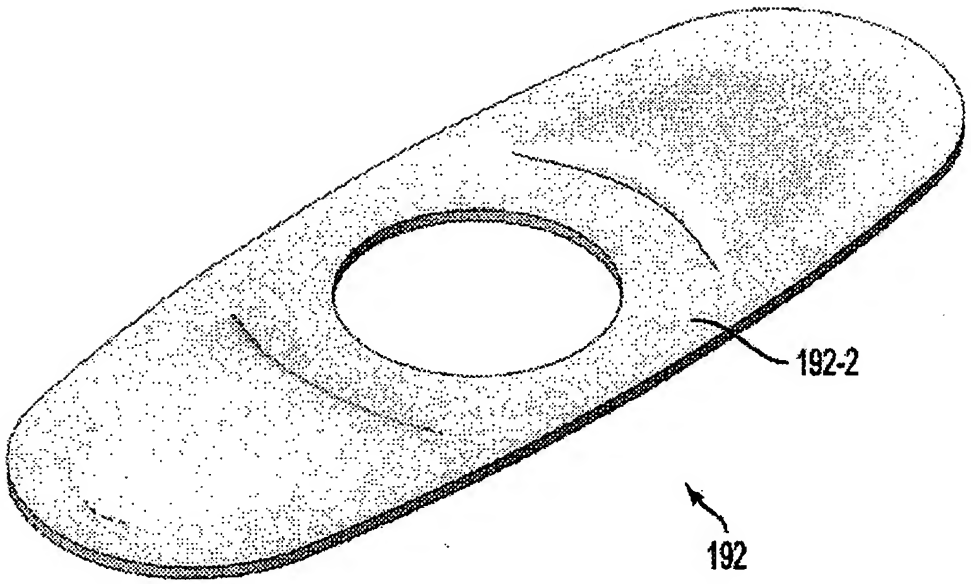

FIG. 37B

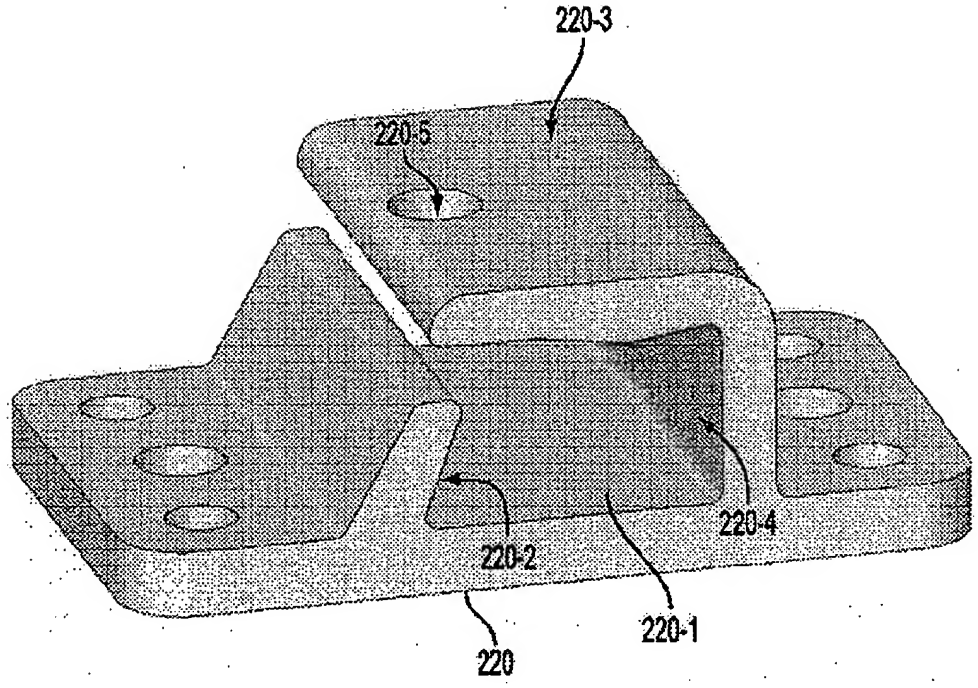

FIG. 38

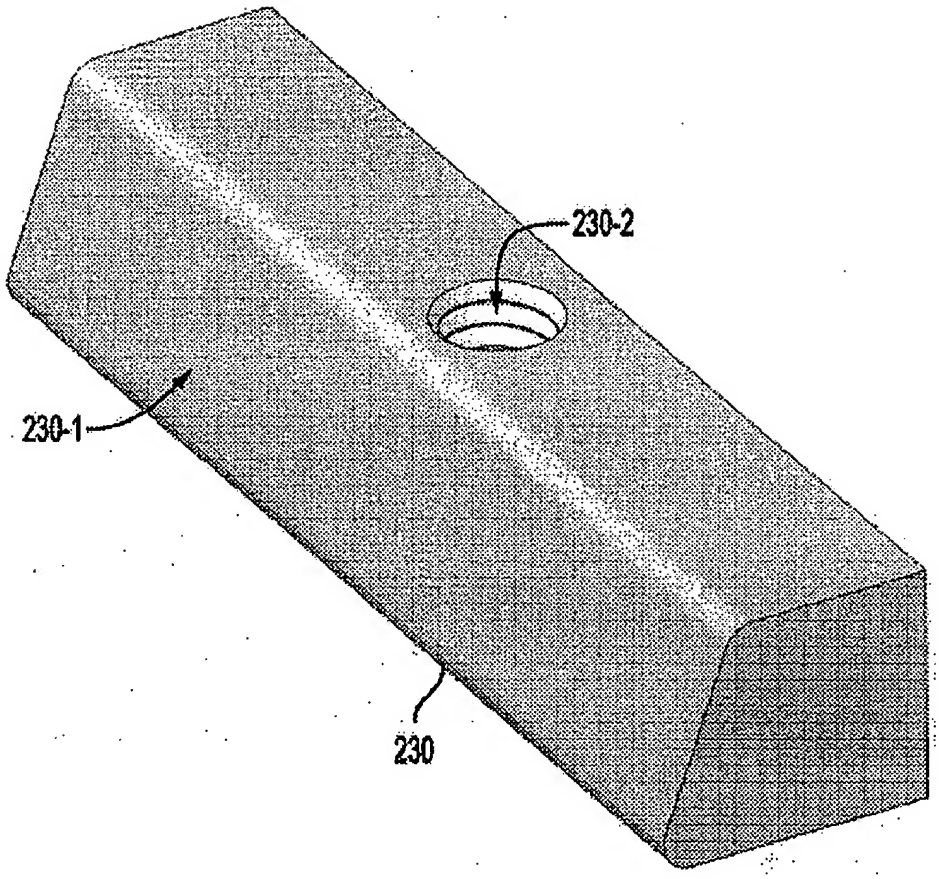

FIG. 39

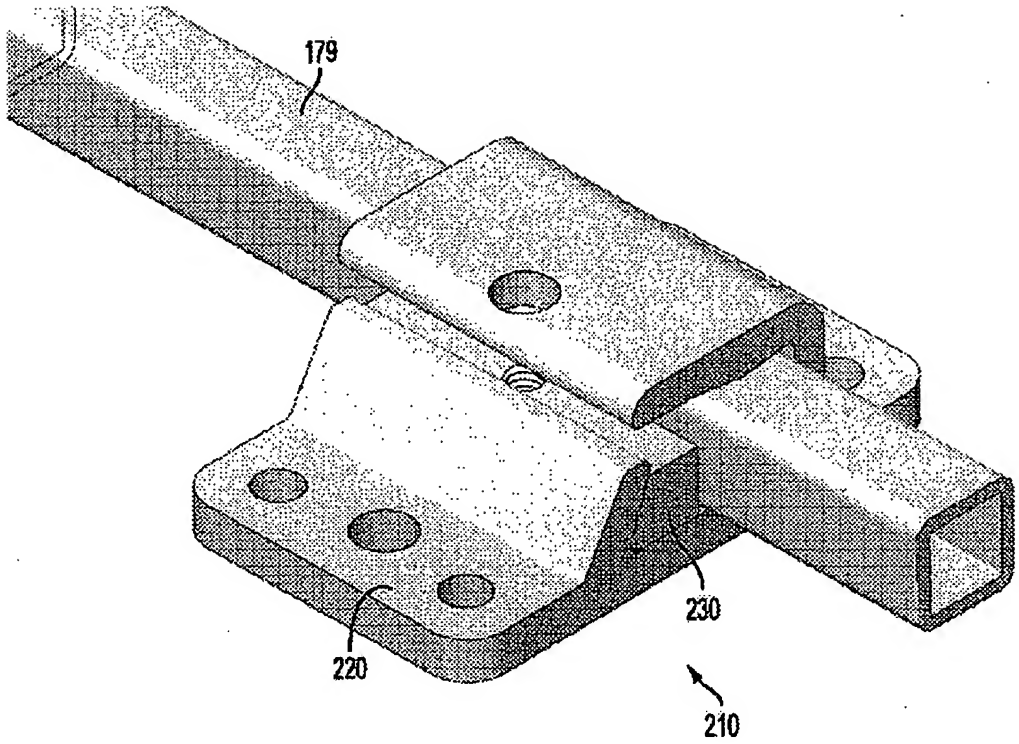

FIG. 40

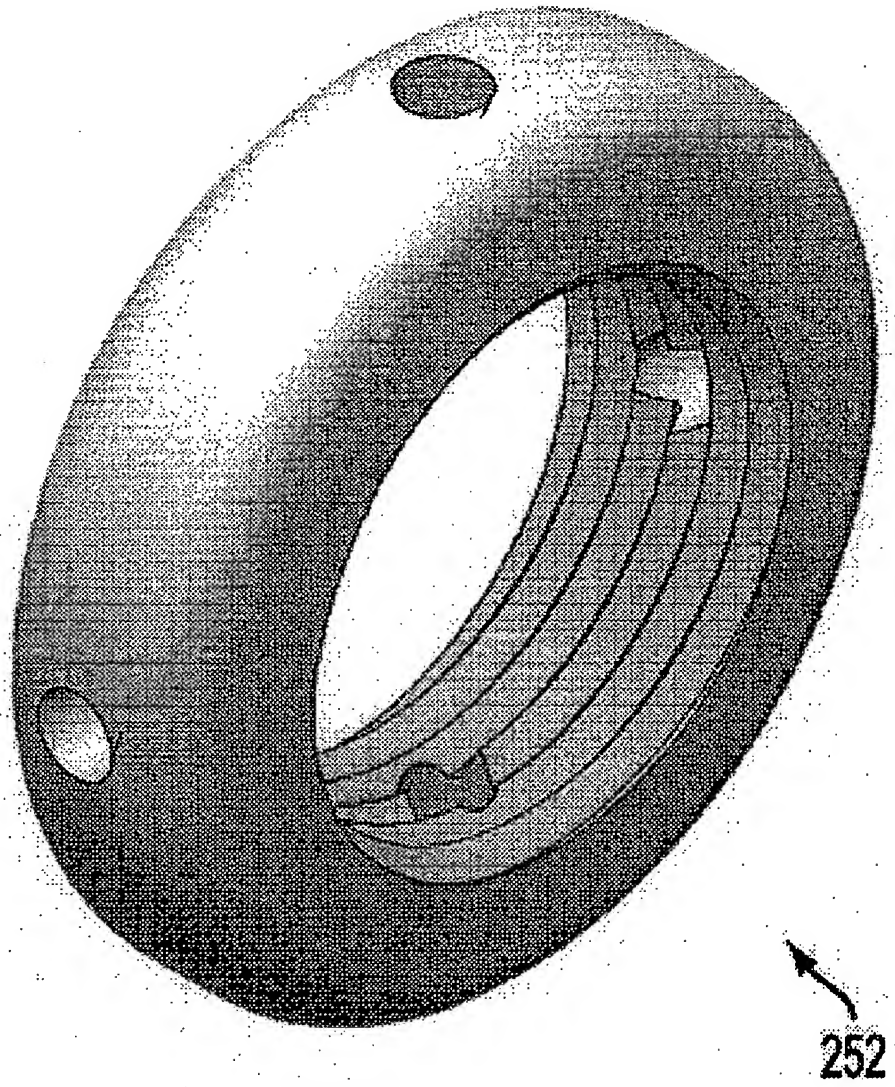

FIG. 41

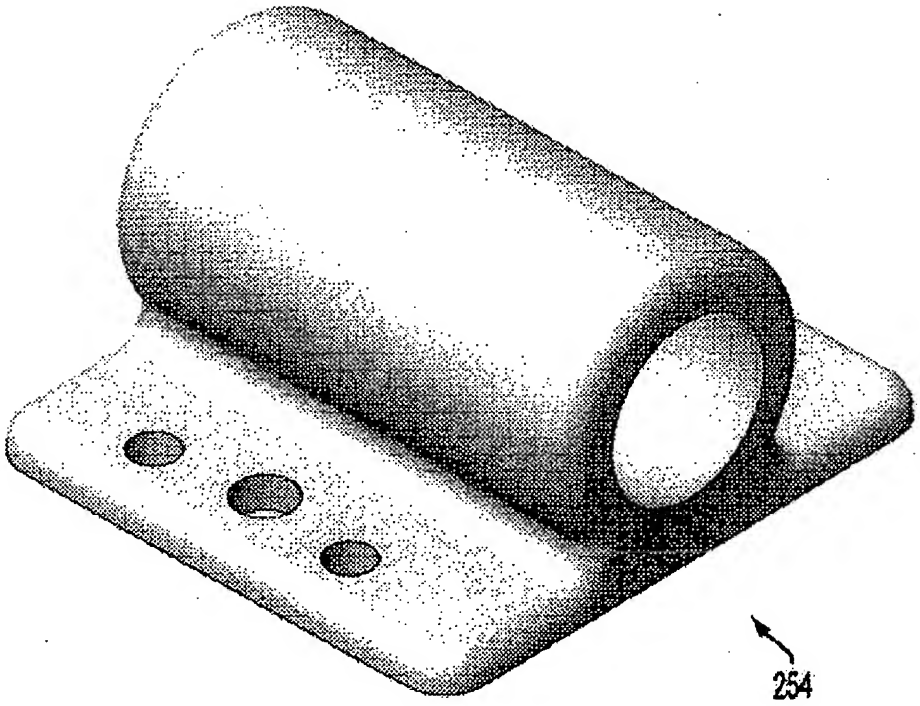

FIG. 42A

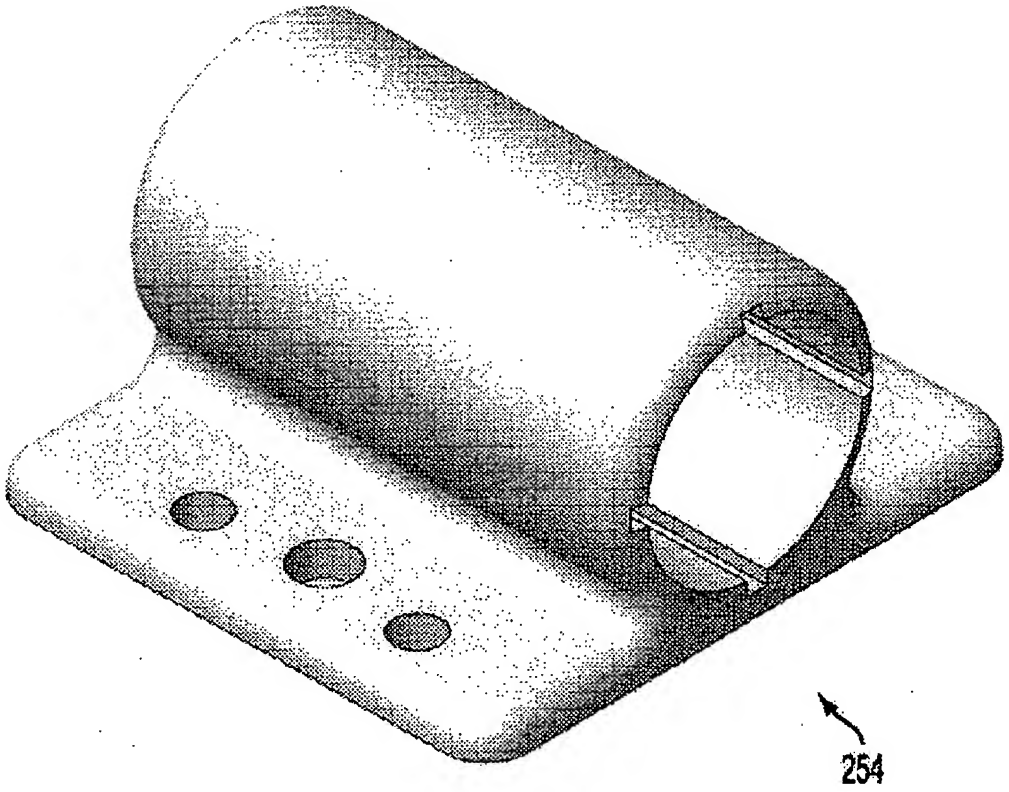

FIG. 42B

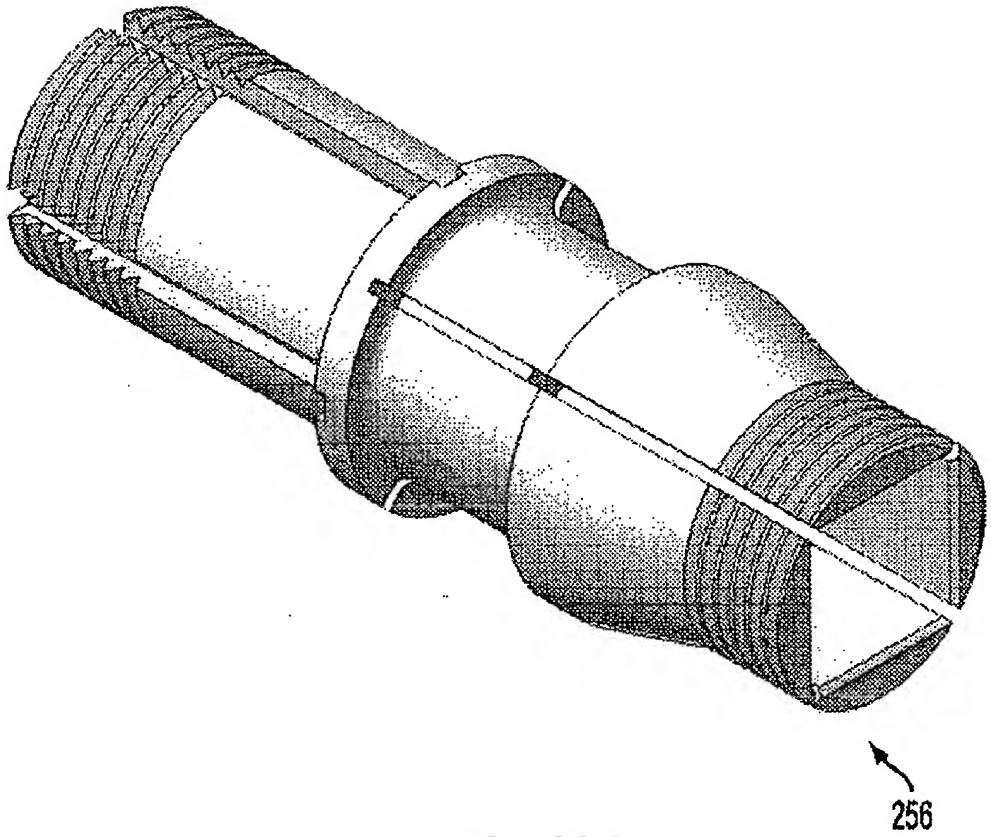

FIG. 43A

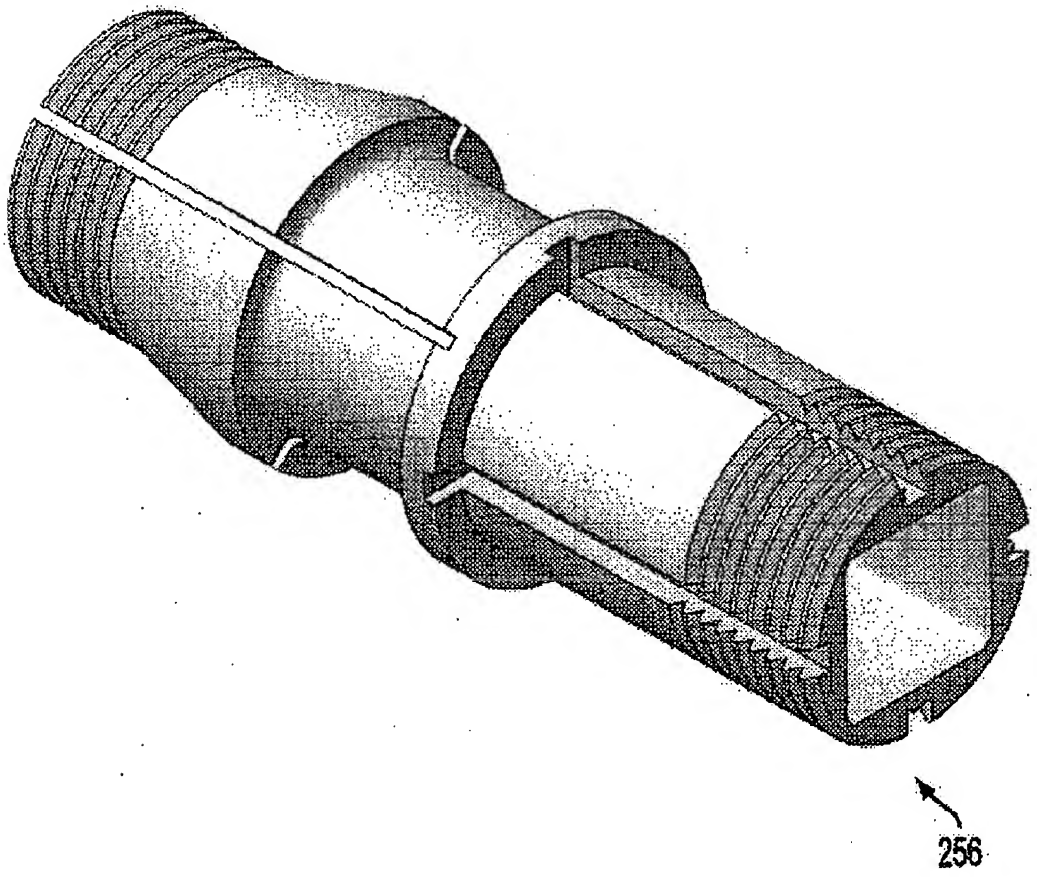

FIG. 43B

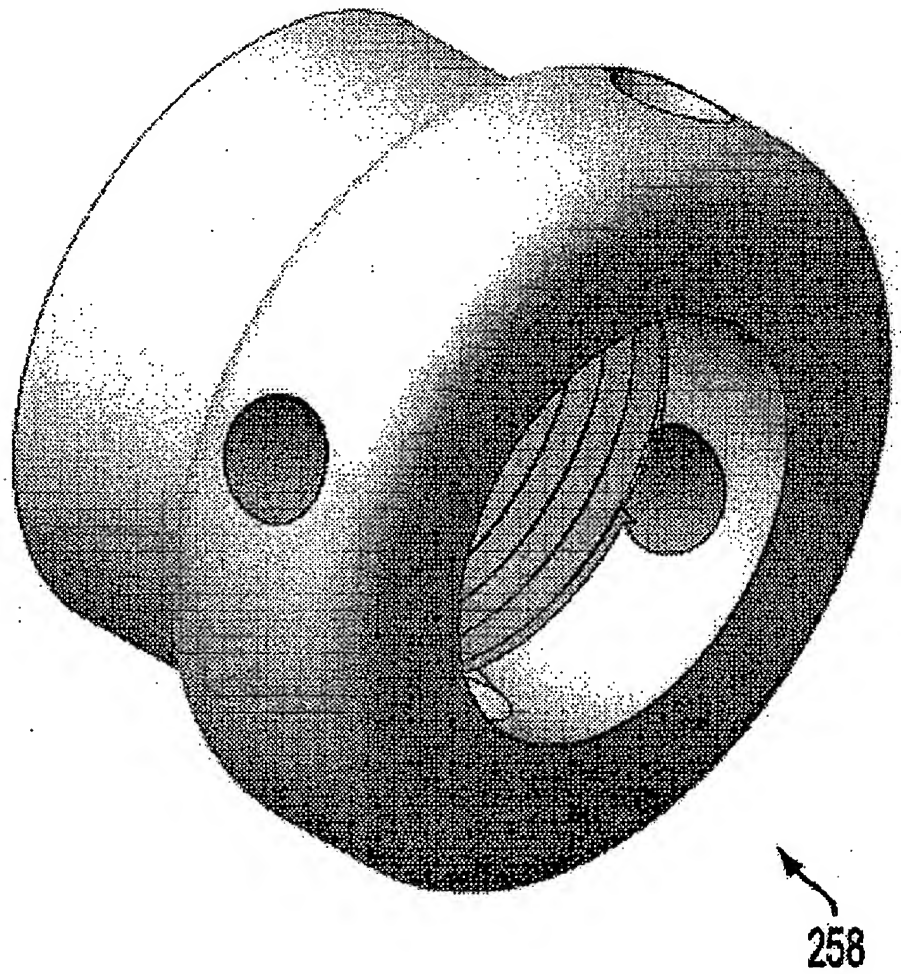

FIG. 44

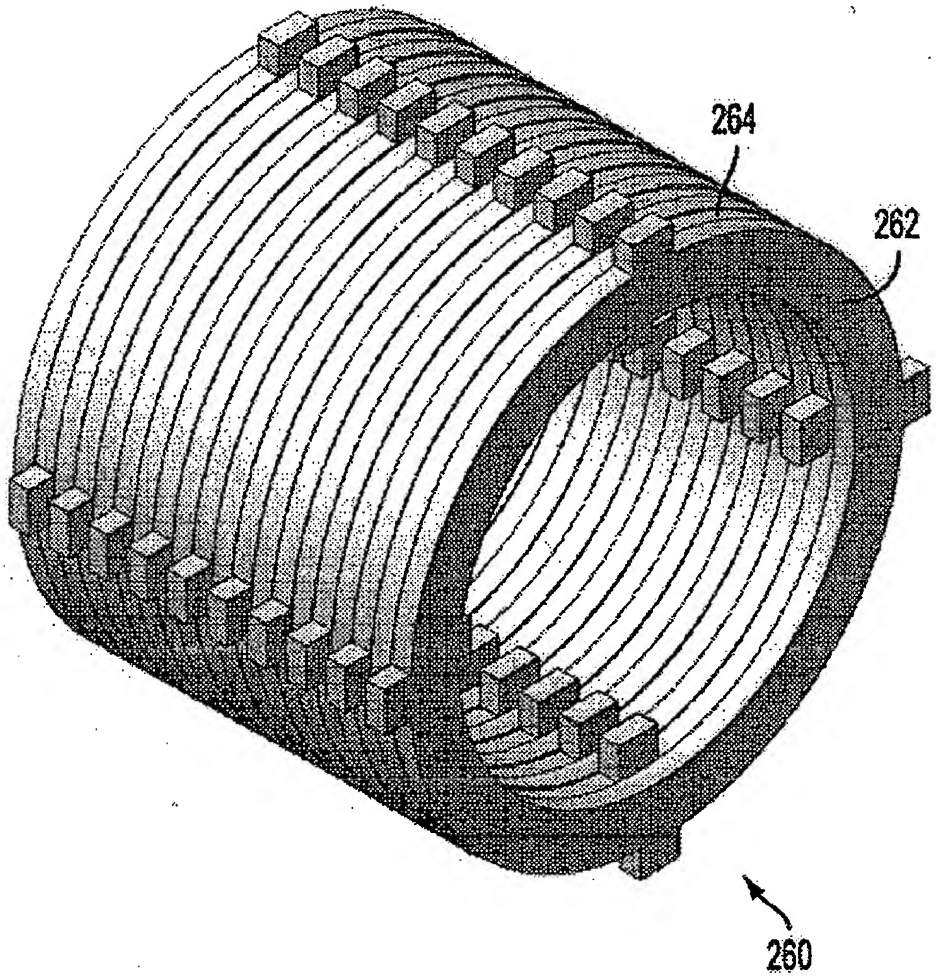

FIG. 45

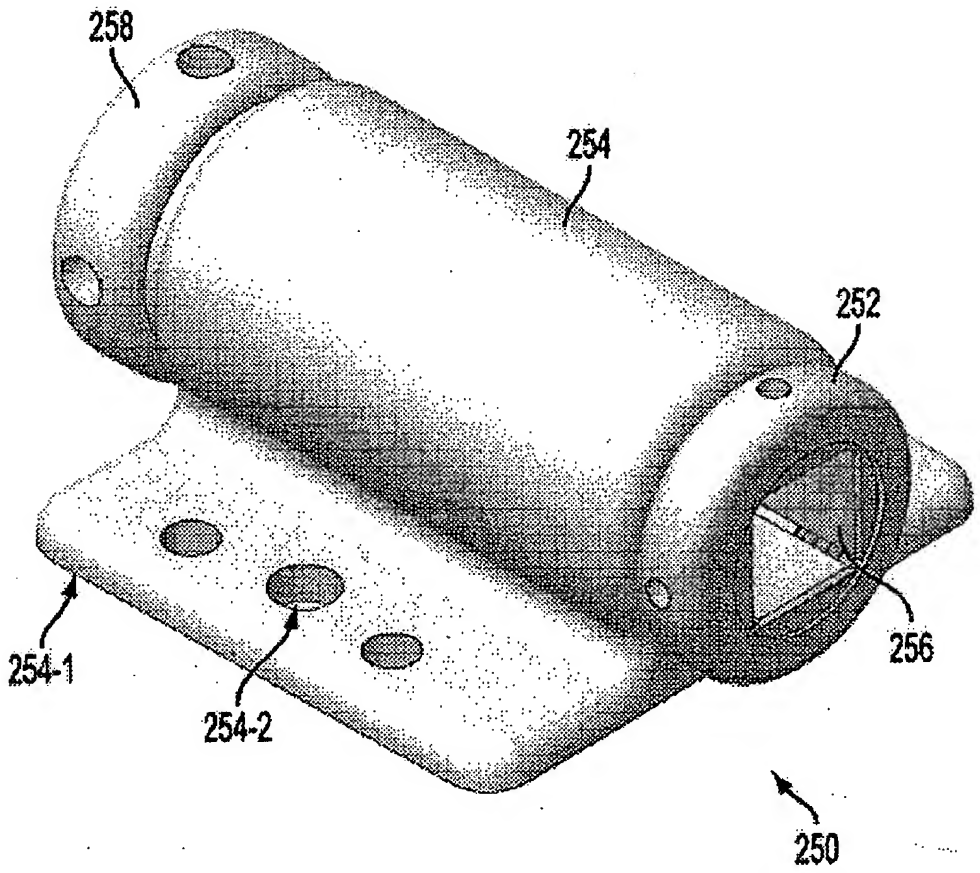

FIG. 46

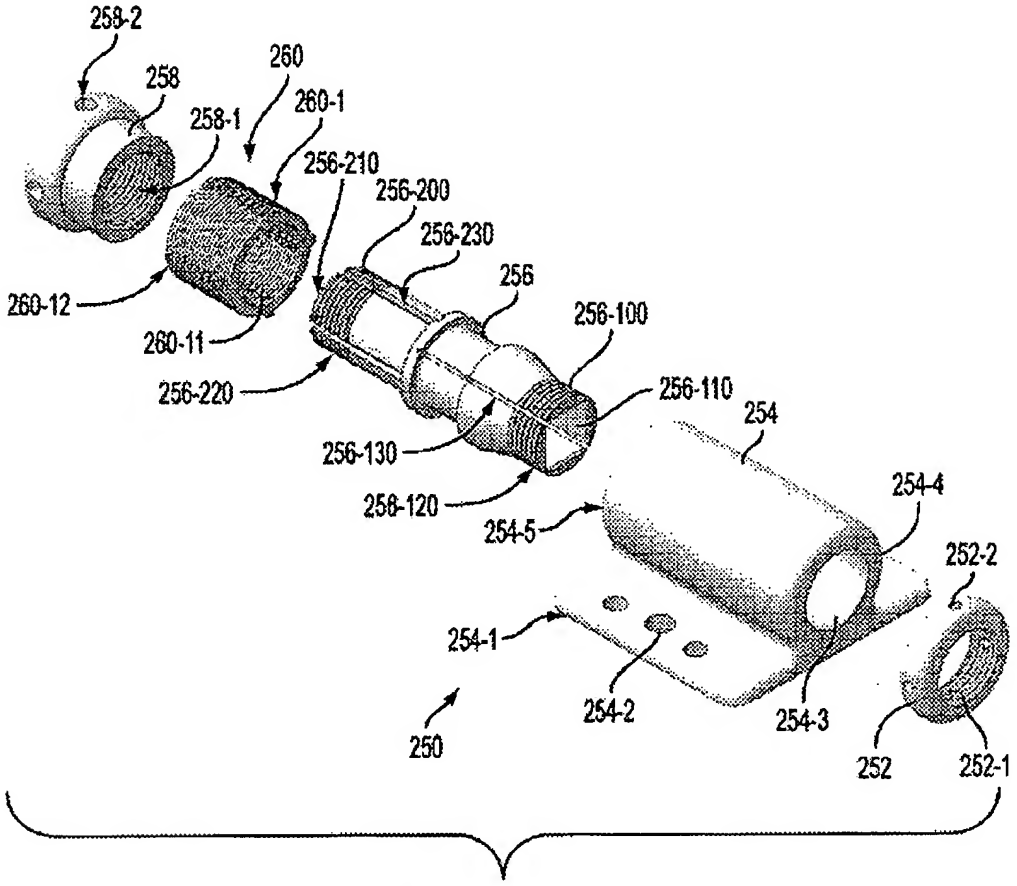
258-2
258
260
260-1
258-1
256-210
256-200
256-230
256
256-100
260-12
260-11
256-220
256-110
254
256-130
254-4
258-120
254-5
252-2
254-1
254-2
254-3
250
252
252-1

FIG. 47

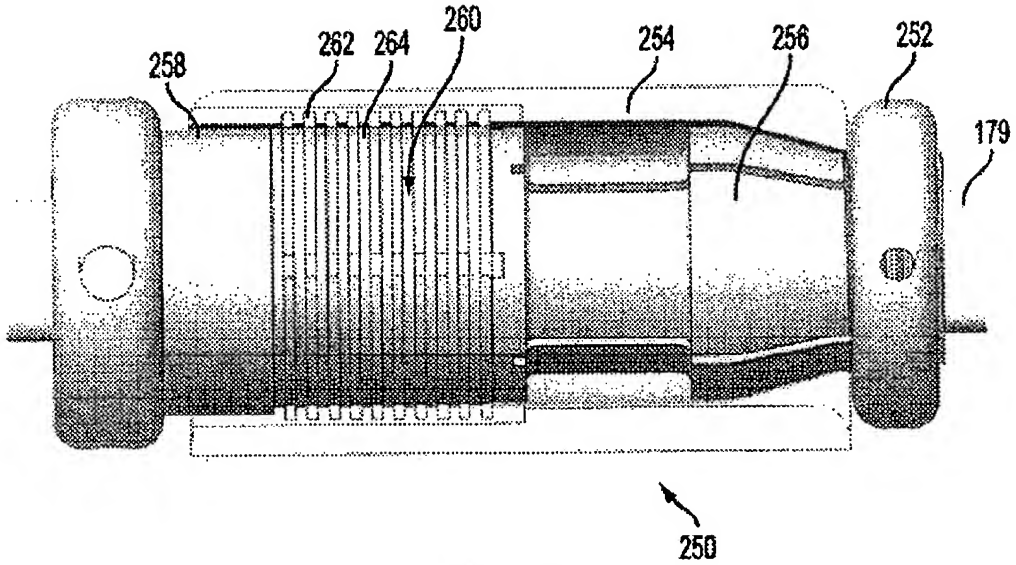

FIG. 48

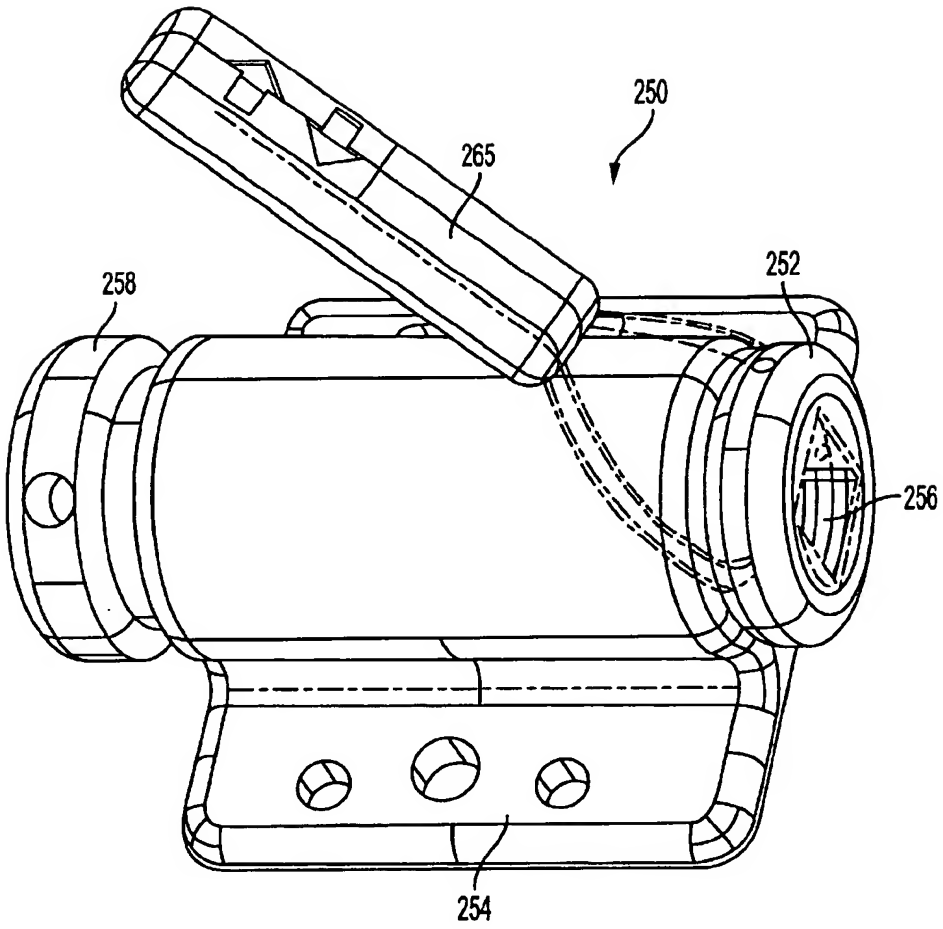

FIG. 49

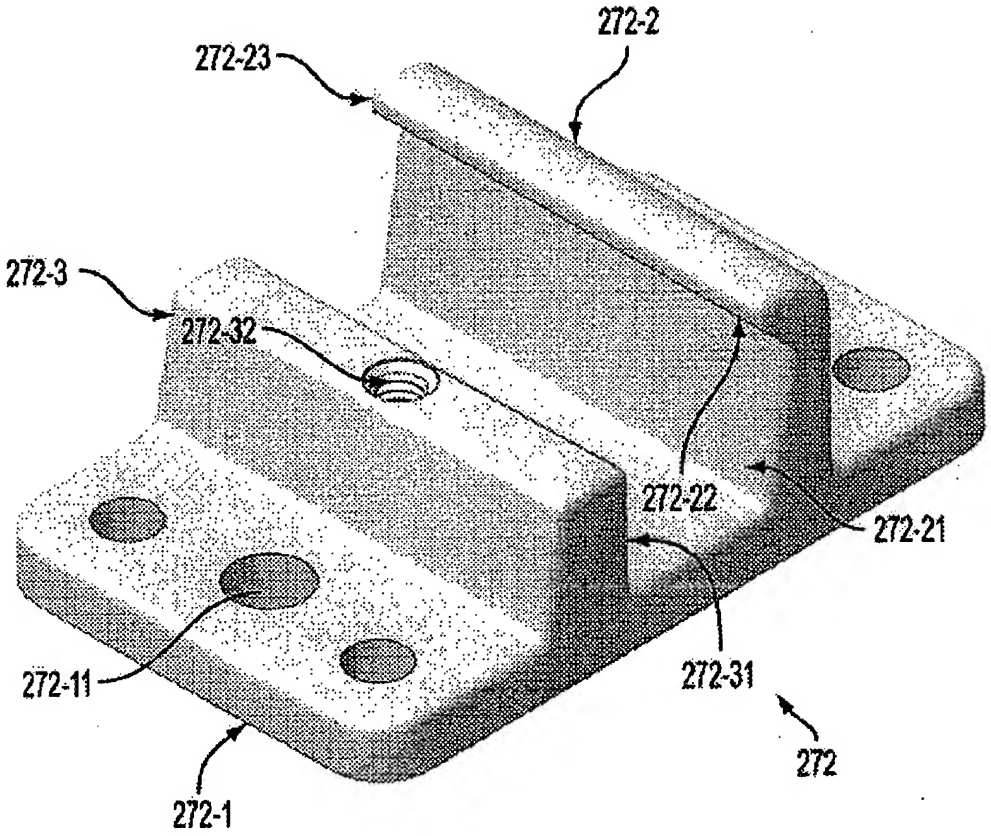

FIG. 50

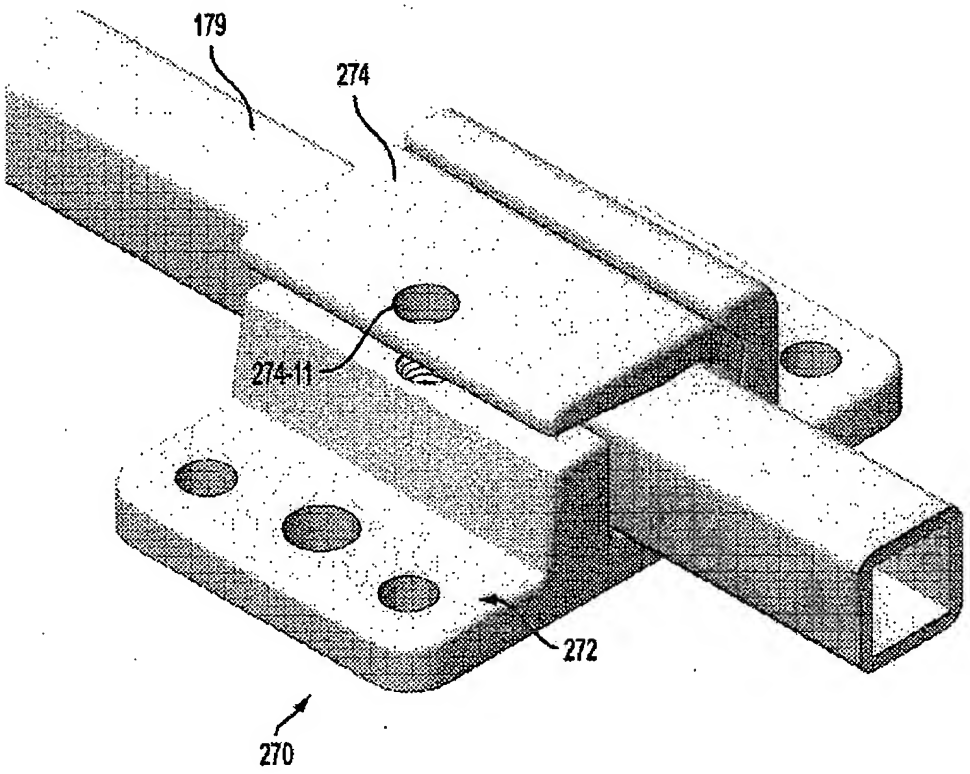

FIG. 51

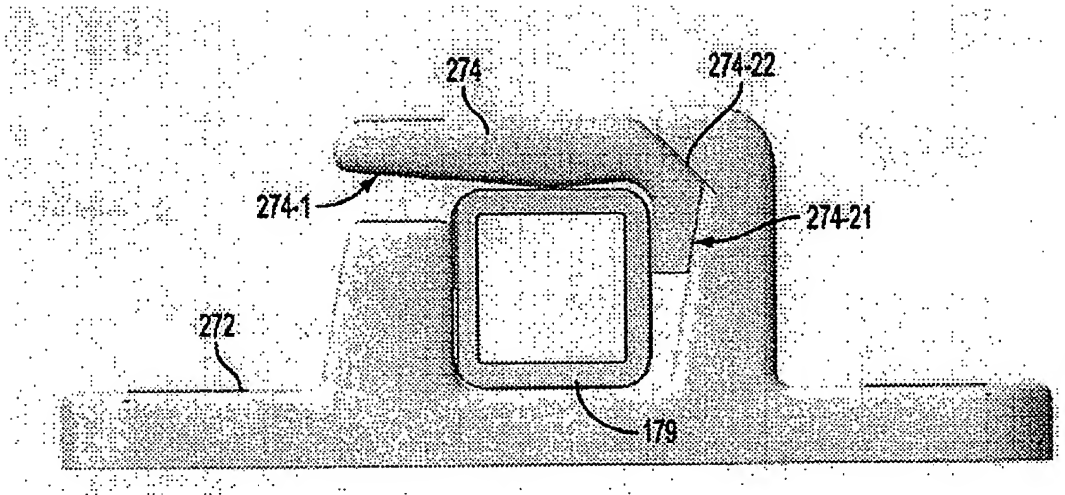

FIG. 52

ADJUSTABLE HEAD SUPPORT FOR CONNECTION TO A WHEELCHAIR

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to provisional application Ser. No. 60/122,396, filed on Mar. 2, 1999, the disclosure of which is incorporated by reference in its entirety herein.

FIELD OF THE INVENTION

The present invention relates to a head support, and more particularly to a head support for connection to a wheelchair.

BACKGROUND OF THE INVENTION

It is known in the conventional art to use structure to support a head of a user of a wheelchair. Often, the user of the wheelchair is unable to adequately support their head during the use and operation of the wheelchair. Since all types of people use wheelchairs, it is desirable to allow the head support structure to be positioned in a variety of configurations. While, it is known to use adjustable head support structures, existing head support structures do not offer enough adjustability to accommodate a wide variance of body types. Accordingly, existing wheel chairs often must be customized for a particular user, thus greatly increasing their cost.

Moreover, existing head support structures often suffer from the disadvantage that they are difficult to adjust.

SUMMARY OF THE INVENTION

In view of the above-discussed disadvantages of conventional wheelchair head supports, it is an object of the invention to provide a head support for a user of a wheel chair that is easily adjustable to a sufficient variety of positions to accommodate most body types.

To achieve the foregoing and other objectives, and in accordance with the purposes of the invention, a head array for a wheelchair is provided that includes multiple pads for contact with different portions of a user's head. Each pad is capable of independent adjustment in three axes as well as being supported on an assembly that allows the pads to be adjusted in position relative to each other. Pads for contact with sides of the head or temple region can be swiveled about three axes to accommodate different shaped heads, as well as being adjustable towards and away from separate pads for contact with back portions of the head. Similarly, a pad for contact with the center back or upper back of the head can be swiveled about three axes to accommodate different shaped heads as well as being adjustable towards and away from separate pads for contact with the lower back of the head, or occipital region.

In one embodiment the head array can include a temple support, an occipital support, a sub-occipital support, and a support structure for adjustably mounting the temple support, the occipital support and the sub-occipital support.

The embodiment of the invention can further include a support structure for the wheelchair head array including a horizontal channel adapted to receive a first component of the wheelchair head array, and a vertical channel adapted to receive a second component of the wheelchair head array, the vertical channel being attached to the horizontal component. The temple support and occipital support can be adjustably connected to the second component, and the sub-occipital support can be adjustably connected to the first component. The vertical channel allows for adjustments to change the vertical distance between the first and second components, and thus the temple support and occipital support can be displaced in a vertical direction relative to the sub-occipital support.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention. In the drawings:

FIG. **1** is an isometric view of the head support assembly of the present invention;

FIG. **2** is an isometric view of the connecting assembly of the present invention;

FIG. **3** is an isometric view of an alternate embodiment of the head array of the present invention;

FIGS. **4A** and **4B** are isometric views of the first swivel ring of the present invention;

FIGS. **5A** and **5B** are isometric views of the second swivel ring of the present invention;

FIG. **6** is an isometric view of the swivel ball of the present invention;

FIG. **7** is a cross-sectional view of the swivel ball of FIG. **6**;

FIG. **8** is an exploded view of the swivel joint of the present invention;

FIG. **9** is an isometric view of another embodiment of the swivel ball of the present invention;

FIGS. **10A** and **10B** are isometric views of the temple arm of the present invention;

FIG. **11** is an exploded view of an alternate embodiment of the swivel joint of the present invention;

FIG. **12** is an isometric view of the ball mount of the present invention;

FIGS. **13A** and **13B** are isometric views of the first half ball mount receiver of the present invention;

FIGS. **14A** and **14B** are isometric views of the second half ball mount receiver of the present invention;

FIG. **15** is an isometric view of an alternate embodiment of the ball mount of the present invention;

FIGS. **16A** and **16B** are isometric views of an alternate embodiment of the first half ball mount receiver of the present invention;

FIG. **17** is an isometric view of the ball post of the present invention;

FIG. **18** is an isometric view of the horizontal channel of the present invention;

FIG. **19** is an isometric view of the vertical channel of the present invention;

FIG. **20** is an isometric view of the slot nut of the present invention;

FIG. **21** is an isometric view of the ball post assembly of the present invention;

FIG. **22** is an isometric view of the end cap of the present invention;

FIG. **23** is an isometric extension rod of the present invention;

FIGS. **24A** and **24B** are isometric views of the first and second joint shells of the present invention;

FIG. **25** is an isometric view of the wedge lock of the present invention;

FIG. 26 is an isometric view of the extension joint of the present invention;

FIG. 27 is another isometric view of the extension joint of the present invention;

FIG. 28 is a cross-sectional view of the extension joint of the present in invention;

FIGS. 29A and 29B are isometric views of the swing support of the present invention;

FIG. 30 is an isometric view of the swing arm of the present invention;

FIGS. 31A and 31B isometric views of the swing lock of the present invention;

FIG. 32 is an isometric view of the swing lock spring of the present invention;

FIG. 33 is an isometric view of the swing arm assembly of the present invention;

FIGS. 34A and 34B are isometric views of the occipital plates of the present invention;

FIGS. 35A and 35B are isometric views of the sub-occipital plates of the present invention;

FIGS. 36A and 36B are isometric views of an embodiment of the sub-occipital plates of the present invention;

FIGS. 37A and 37B are isometric views of the temple plate of the present invention;

FIG. 38 is an isometric view of the mounting bracket of the present invention;

FIG. 39 is an isometric view of the mounting wedge of the present invention;

FIG. 40 is an isometric view of the wheelchair mount of the present invention;

FIG. 41 is an isometric view of the release ring of the present invention;

FIGS. 42A and 42B are isometric views of the mounting collet of the present invention;

FIGS. 43A and 43B are isometric views of the collet of the present invention;

FIG. 44 is an isometric view of the clutch tightening ring of the present invention;

FIG. 45 is an isometric view of the clutch plate assembly of the present invention;

FIG. 46 is an alternate embodiment of the wheelchair mount of the present invention;

FIG. 47 is an isometric view of the wheelchair mount of FIG. 46;

FIG. 48 is a cross-sectional view of the wheelchair mount and the mounting collet of the present invention;

FIG. 49 is an isometric view of the release ring tightener of the present invention;

FIG. 50 is an isometric view of an alternate embodiment of the mounting bracket of the present invention;

FIG. 51 is an isometric view of the wheelchair mount of the present invention; and

FIG. 52 is a cross-sectional view of the wheelchair mount of FIG. 51.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawing figures, FIG. 1 is an isometric view of a head support assembly of the present invention. FIG. 2 is an isometric view of a connecting assembly of the present invention for connecting the head support assembly to a wheel chair. The head support assembly 1000 includes a head array assembly, and a connecting assembly.

Head Array Assembly-First Embodiment

The first embodiment of the head array assembly is the head array 100. The head array 100 includes first and second temple support assemblies 110, an occipital support assembly 112, a sub-occipital support assembly 114, and a support structure assembly 116.

First and Second Temple Support Assemblies

The first and second temple support assemblies 110 include a temple plate 192 connected to a temple arm 134. FIGS. 37A and 37B are isometric views of the temple plate of the present invention. The temple plate 192 includes a first contact surface 192-1 and a second contact surface 192-2. The first contact surface 192-1 can include a concave portion 192-3. The second contact surface 192-2 can include a convex portion 192-3. The temple plate 192 can be adapted to provide support for a temple of the head of a user of a wheelchair. Alternately, or in conjunction with providing support, the temple plate can be adapted to control one or more of a variety of functions of the wheelchair (e.g. directional control, summon assistance, etc.). Preferably, the first contact surface 192-1 including the concave portion 192-3 is oriented proximate the temple of the head of the user of the wheelchair. By this arrangement, it is believed that the temple plate 192 can better support the head of the user and permit control of the wheelchair. The temple plate 192 used in the first and second temple support assemblies 110 can be any suitable commercial part.

FIGS. 10A and 10B are isometric views of the temple arm of the present invention. The temple arm 134 can have a variety of shapes. The temple arm 134 can be substantially V-shaped. The temple arm 134 can also include a first end having a tapered section and a second end having an un-tapered section.

The temple plate 192 can be connected to the temple arm 134 by a variety of fastening techniques. The fastening techniques include fixed or swivel techniques.

In the case of a swivel technique, the temple plate 192 can be connected to the temple arm by a swivel joint 120. FIGS. 4A and 4B are isometric views of the first swivel ring of the present invention. FIGS. 5A and 5B are isometric views of the second swivel ring of the present invention. FIG. 6 is an isometric view of the swivel ball of the present invention. FIG. 7 is a cross-sectional view of the swivel ball of FIG. 6. FIG. 8 is an exploded view of the swivel joint of the present invention. The swivel joint 120 includes a first swivel ring 124, a second swivel ring 122, and a swivel ball 126.

The first swivel ring 124 includes a first swivel ball channel 124-1, a first swivel ring void 124-2, a first swivel ring ball void 124-3, and a first swivel ring contact surface 124-4. The second swivel ring 122 includes a second swivel ball channel 122-1, a second swivel ring void 122-2, a second swivel ring ball void 122-3, and a second swivel ring contact surface 122-4. The second swivel ring void 122-2 can include internal threads. The swivel ball 126 includes an arm opening 126-1 (to be described in detail later). The swivel ball 126 is disposed between the first swivel ring contact surface 124-4 of the first swivel ring 124 and the second swivel ring contact surface 122-4 of the second swivel ring 122, such that removal of the swivel ball 126 from the swivel joint 120 is substantially prevented by the first swivel ball channel 124-1 and the second swivel ball channel 122-1. At least one fastener (not shown) is inserted through the first swivel ring void 124-2 and the second swivel ring void 122-2 to substantially prevent relative movement between the first swivel ring 124 and the second swivel ring 122. As the distance between the first swivel ring 124 and the second swivel ring 122 is decreased due to

tightening of the fastener (not shown), reorientation of the swivel ball **120** is substantially prohibited by interference between the swivel ball **126** and the first and second swivel ring contact surfaces **124-4** and **122-2**, respectively.

The first end having a tapered section of the temple arm **134** is secured in the arm opening **126-1** of the swivel ball **126** by one or more of a variety of fastening techniques. An interference fit between the tapered section of the temple arm **134** and the arm opening **126-1** of the swivel ball **126** can be used to substantially prevent undesired un-attachment of the temple plate **192** and the temple arm **134**.

It is to be understood that the first and second temple support assemblies **110** can be mirror images or each other, or alternately can be of different configurations from each other. Additionally, each of the first and second temple support assemblies **110** can be adapted for one or more purposes (e.g. the first temple support assembly is configured to support the head of a user of the wheelchair, and the second temple support assembly is configured to control one or more functions of the wheelchair and/or support the head of a user of the wheelchair, etc.).

Occipital Support Assembly

The occipital support assembly **112** includes an occipital plate **194**. FIGS. **34A** and **34B** are isometric views of the occipital plates of the present invention. The occipital plate **194** includes a concave surface **194-1** and a convex surface **194-2**. The concave surface **194-1** can be shaped such that the head of the user of the wheelchair is adequately supported. The occipital plate **194** used in the occipital support assembly **112** can be any suitable commercial part.

Sub-occipital Support Assembly

The sub-occipital support assembly **114** includes sub-occipital plates **196**. FIGS. **36A** and **36B** are isometric views of an embodiment of the sub-occipital plates of the present invention.

The sub-occipital plates **196** each include a concave surface **196-1** and a convex surface **196-2**. At least one of the concave surfaces **196-1** can be shaped such that the head of the user of the wheelchair is adequately supported. The sub-occipital plates **196** used in the sub-occipital support assembly **114** can be any suitable commercial part.

Support Structure Assembly

The support structure assembly **116** includes a horizontal channel **164** and a vertical channel **168**. FIG. **18** is an isometric view of the horizontal channel of the present invention. FIG. **19** is an isometric view of the vertical channel of the present invention. The horizontal and vertical channels **164** and **168**, respectively, can have a substantially C-shaped cross section. The horizontal and vertical channels **164** and **168**, respectively, can be substantially the same length or alternately different lengths. The vertical channel **168** can include an angled surface **164-1** to facilitate attachment of the horizontal and vertical channels **164** and **168**, respectively. Alternately, the horizontal channel **164** can include an angled surface to facilitate attachment of the horizontal and vertical channels **164** and **168**, respectively.

The support structure assembly **116** further includes a ball post assembly **160**. The ball post assembly includes a ball post **162** and a slot nut **168**. FIG. **17** is an isometric view of the ball post of the present invention. FIG. **20** is an isometric view of the slot nut of the present invention. FIG. **21** is an isometric view of the ball post assembly of the present invention.

The ball post **162** includes a swivel ball portion **162-1**, a support portion **162-2**, and a threaded portion **162-3**. A void **162-4** is disposed in the support portion **162-2** substantially perpendicular to a centerline axis of the ball post **162**.

The slot nut **166** includes an internally threaded void **166-1**. The internally threaded void **166-1** is substantially sized and shaped to attachably receive the threaded portion **162-3** of the ball post **162**. The slot nut **166** can have substantially the same cross section as the channels **164** and **166**.

The ball post assembly **160** can be disposed within the channels **164** or **168**. The slot nut **166** can be sized and shaped such that the slot nut **160** is permitted to slidingly and/or without interference move within the openings of the channels **164** or **168**. Additionally, the slot nut **166** can be sized and shaped such that the slot nut **160** is permitted to travel along the threaded portion **162-3** of the ball post **162**, until the slot nut **160** is substantially interfering with a portion of the channels **164** or **168**. A tool (not shown) can be disposed within the void **162-4** of the ball post **162** to facilitate rotation of the ball post around an axis. By this arrangement, the ball post assembly **160** can be positioned at any of an infinite number of positions along the channels **164** or **168**.

The support structure assembly **116** further includes a swivel joint **140**. The swivel joint **140** includes the first swivel ring **124** and the second swivel ring **122**. The swivel ball portion **162-1** of the ball post assembly **160** can be disposed between the first swivel ring contact surface **124-4** of the first swivel ring **124** and the second swivel ring contact surface **122-4** of the second swivel ring **120**. The swivel joint **140** is similar to the swivel joint **120** in other respects. Swivel joints **140** can be attached to the occipital and sub-occipital support assemblies **112** and **114**, respectively. By this arrangement, the occipital and sub-occipital support assemblies **112** and **114** can be removably and movably attached with the support structure assembly **116**.

The support structure assembly **116** further includes a swing arm assembly **150**. FIGS. **29A** and **29B** are isometric views of the swing support of the present invention. FIG. **30** is an isometric view of the swing arm of the present invention. FIGS. **31A** and **31B** are isometric views of the swing lock of the present invention. FIG. **32** is an isometric view of the swing lock spring of the present invention. FIG. **33** is an isometric view of the swing arm assembly of the present invention. Swing lock **156** may be used to engage a locking surface of swing support **152** to prevent swing arm **154** from swinging. Preferably, moving swing lock **156** to compress swing lock spring **158** disengages swing lock **156** from swing support **152** and allows swing arm **154** to rotate backwards. When swing arm **154** is rotated forward, a ramp lead-in on swing support **152** may engage a corresponding ramp on swing lock **156** and force swing lock **156** to compress swing lock spring **158** so that swing lock **156** automatically engages its locking surface with the corresponding locking surface on swing support **152**. The swing support **152** is disposed on an end of the vertical channel **168**.

The support structure assembly **116** further includes a swivel joint **130**. FIG. **9** is an isometric view of another embodiment of the swivel ball of the present invention. FIG. **11** is an exploded view of an alternate embodiment of the swivel joint of the present invention. The swivel joint **130** includes the first swivel ring **124**, the second swivel ring **122**, and a swivel ball **132**. The swivel ball **132** includes a swivel ball central void **132-1**, and first and second voids **132-2** and **132-3**, respectively. The central void **132-1** can be sized and shaped to receive the second end of the temple arm **134** (discussed in detail later). Preferably, the central void **132-1** has a substantially constant radius and a centerline about coaxial with the first and second voids **132-2** and

132-3, respectively. The first void 132-2 can be formed through a middle of the swivel ball 132 and extend from a first pole of the swivel ball 132 to a depth of about ⅔ to ¾ of a maximum diameter of the swivel ball 132. The second void 132-3 can be formed through the middle of the swivel ball 132 and extend from a second pole substantially opposite the first pole of the swivel ball 132 to a depth of about ⅔ to ¾ of a maximum diameter of the swivel ball 132, substantially perpendicular to the first void 132-2. The swivel joint 130 is similar to the swivel joint 120 in other respects.

The second end of the temple arm 134 is slidably received in the central void 132-1 of the swivel ball 132. The temple arm 134 can be disposed within the central void 132-1 such that a desired length protrudes from without the swivel ball 130. As the distance between the first swivel ring 124 and the second swivel ring 122 is decreased due to tightening of the fasteners (not shown), reorientation of the swivel ball 130 is substantially prohibited. Additionally, the first and second voids 132-2 and 132-3, respectively, permit structure of the swivel ball 130 to elastically protrude into the central void 132-1. By this arrangement, an interference fit is achieved between the swivel ball 130 and the temple arm 134. The temple arm 134 is substantially prohibited from being removed from the swivel ball 130. By this arrangement, the first and second temple support assemblies 110 can be removably and movably attached with the support structure assembly 116.

The support structure assembly 116 can include an end cap 167. FIG. 22 is an isometric view of the end cap of the present invention. The end cap 167 can be used to cap an end of the channels 164 and/or 168.

Head Array Assembly—Second Embodiment

The second embodiment of the head array assembly is the alternate head array 300. The alternate head array 300 includes the first and second temple support assemblies 110, the occipital support assembly 112, an alternate sub-occipital support assembly 302, and an alternate support structure assembly 304. FIG. 3 is an isometric view of an alternate embodiment of the head array of the present invention.

Alternate Sub-occipital Support Assembly

The alternate sub-occipital support assembly 302 can include a single sub-occipital plate 310. FIGS. 35A and 35B are isometric views of the sub-occipital plates of the present invention.

The sub-occipital plate 310 includes a concave surface 310-1, a convex surface 310-2, and flat regions 310-3. The concave surface 302-1 can be shaped such that the head of the user of the wheelchair is adequately supported. The flat regions can be adapted to accommodate plastic deformation, thereby permitting the user of the alternate head array 300 to obtain a desired level of support. The sub-occipital plate 310 used in the sub-occipital support assembly 310 can be any suitable commercial part.

Alternate Support Structure Assembly

The alternate support structure assembly 304 does not need a horizontal channel 164. A single ball post assembly 160 is used to secure the alternate sub-occipital support assembly 302 and the alternate support structure assembly 304.

Connecting Assembly—First Embodiment

A first embodiment of the connecting assembly is connector 200. FIG. 2 is an isometric view of the connecting assembly of the present invention. The connector 200 includes extension rods 178 and 179, an extension joint 170, ball mount 182, first and second half ball mount receivers 188 and 184, respectively, and wheelchair mounts 210, 250, or 270.

Extension Rods

The connector 200 includes the extension rods 178 and 179. FIG. 23 is an isometric view of the extension rod of the present invention. Extension rods 178 and 179 include a joint portion 178-1 and 179-1, respectively, and extension portions 178-2 and 179-2, respectively. A length of each of the extension portions 178-2 and 179-2 can differ from one another.

Extension Joint

The extension joint 170 includes first and second joint shells 174 and 172, respectively, and a wedge lock 176. FIGS. 24A and 24B are isometric views of the first and second joint shells of the present invention. FIG. 25 is an isometric view of the wedge lock of the present invention. FIG. 26 is an isometric view of the extension joint of the present invention. FIG. 27 is another isometric view of the extension joint of the present invention. FIG. 28 is a cross-sectional view of the extension joint of the present in invention. The extension joint 170 includes first and second joint shells 174, 172 and a wedge lock 176. The first and second joint shells include rotation portions 170-1. The rotation portions 170-1 of the extension joint 170 are adapted to secure the joint portions 178-1 and 179-1 of the extension rods 178 and 179, respectively. The first and second joint shells 174 and 172 further include translation portions 170-5. The translation portions 170-5 of the extension joint 170 are adapted to secure the extension portions 178-2 and 179-2 of the extension rods 178 and 179, respectively and/or ball mount 182 (to be described in detail later).

The wedge lock 176 defines a void 176-1. The void 176-1 can be internally threaded. The first and second joint shells 174 and 172 include a fastener hole. A fastener (not shown) is inserted into the fastener holes of the first and second joint shells 174 and 172, and the void 176-1 of the wedge lock 176. By this arrangement, tightening of the fasteners urges the wedge lock 176 towards either the first or second joint shell 174 and 172, respectively, the wedge lock 176 interfering with the extension portion 178-2 and 179-2 of the extension rod 178 and 179, respectively, or the ball mount 182.

In a preferred arrangement of the connector 200, the extension rod 178 is connected to a first extension joint 170 and a second extension joint 170. The extension rod 179 is also connected to the second extension joint 170.

Ball Mount and First and Second Half Ball Mount Receiver

The connection between head array assembly and the connecting assembly 200 includes a ball mount 182 disposed in a ball mount receiver. FIG. 12 is an isometric view of the ball mount of the present invention. FIGS. 13A and 13B are isometric views of the first half ball mount receiver of the present invention. FIGS. 14A and 14B are isometric views of the second half ball mount receiver of the present invention. A ball mount 182 includes a ball portion 182-1 and a support portion 182-2. The ball portion 182-1 is disposed at an end of the support portion 182-2. The support portion 182-2 can be disposed in a translation portions 170-5 of the extension joint 170. A first half ball mount receiver 188 includes a first channel 188-1, a second channel 188-2, a first ball mount void 188-3, and a first ball mount contact surface 188-4. The first ball mount void 188-3 can include an internal thread. A second half ball mount receiver 184 includes a second ball mount void 184-1, and a second ball

mount contact surface **184-2**. The ball portion **182-1** of the ball mount **182** can be secured between the first ball mount contact surface **188-4** and the second ball mount contact surface **184-2**. Fasteners (not shown) are disposed in the first ball mount void **188-3** and the second ball mount void **184-1**. As the distance between the first half ball mount receiver **188** and the second half ball mount receiver **184** is decreased due to tightening of the fasteners (not shown), reorientation of the ball mount **182** is substantially prohibited.

In a preferred arrangement of the connector **200**, the extension rod **178** is connected to a first extension joint **170** and a second extension joint **170**. The extension rod **179** is also connected to the second extension joint **170**. The support portion **182-2** of the ball mount **182** is connected to the first extension joint **170**. The first and second half ball mount receivers **188** and **184** are attached to the head array assembly.

Wheelchair Mount—First Variation

The wheelchair mount **210** includes a mounting bracket **220** and mounting wedge **230**. FIG. **38** is an isometric view of the mounting bracket of the present invention. FIG. **39** is an isometric view of the mounting wedge of the present invention. FIG. **40** is an isometric view of the wheelchair mount of the present invention. The mounting bracket **220** includes a wheelchair attachment void **220-1**. The wheelchair attachment void **220-1** permits the mounting bracket **220** to be secured to the wheelchair (not shown) through the use of wheel chair fasteners.

The mounting bracket **220** further includes a wedge wall **220-2** and an extension stop **220-3**. The extension stop **220-3** defines an extension rod channel **220-4**. The extension stop **220-3** further includes a wedge fastener void **220-5**.

The mounting wedge **230** includes a corresponding wall **230-1** and a mounting wedge fastener void **230-2**. The mounting wedge **230** can be disposed in the extension rod channel **220-4** of the mounting bracket **220**, such that the corresponding wall **230-1** of the mounting wedge **230** is proximate the wedge wall **220-2** of the mounting bracket **220** and the mounting wedge fastener void **230-2** of the mounting wedge **230** is operatively aligned with the wedge fastener void **220-5** of the mounting bracket **220**. The extension rod **179** is also disposed in the extension rod channel **220-4** of the mounting bracket. A fastener (not shown) is disposed in the mounting wedge fastener void **230-2** of the mounting wedge **230** and the wedge fastener void **220-5** of the mounting bracket **220**. By this arrangement, the mounting wedge **230** can secure the extension rod **179** within the extension rod channel **220-4** of the mounting bracket **220** when the fastener is tightened. Thus, the extension rod **179** can be substantially secured within the mounting bracket **220**.

Wheelchair Mount—Second Variation

The wheelchair mount **250** can include release ring **252**, mounting collet **254**, collet **256**, clutch plate assembly **260** and clutch tightening ring **258**. FIG. **41** is an isometric view of the release ring of the present invention. FIGS. **42A** and **42B** are isometric views of the mounting collet of the present invention. FIGS. **43A** and **43B** are isometric views of the collet of the present invention. FIG. **44** is an isometric view of the clutch tightening ring of the present invention. FIG. **45** is an isometric view of the clutch plate assembly of the present invention. FIG. **46** is an alternate embodiment of the wheelchair mount of the present invention. FIG. **47** is an isometric view of the wheelchair mount of FIG. **46**. FIG. **48** is a cross-sectional view of the wheelchair mount and the mounting collet of the present invention. FIG. **49** is an isometric view of the release ring tightener of the present invention.

The release ring **252** includes an internally threaded surface **252-1**. The internally threaded surface **252-1** is adapted for removable connection with the collet **256** (to be described in detail later). The release ring **252** also includes a tool void **252-2**. The tool void **252-2** is adapted to allow a ring removal tool to remove the release ring **252** (to be described in detail later).

The mounting collet **254** includes a wheelchair mount surface **254-1**. The wheelchair mounting surface includes a wheelchair fastener void **254-2** disposed therethrough. The mounting collet can be mounted to a wheelchair (not shown) through the use of fasteners (not shown) disposed in the wheelchair fastener void **254-2** of the mounting collet **254**. The mounting collet **254** further includes a collet channel **254-3** and a collet opening **254-5**. The collet channel **254-3** is sized and shaped to receive the collet **256**, clutch plate assembly **260**, and clutch tightening ring **258** (to be described in detail later). The mounting collet **254** further includes clutch grooves **254-4**. The clutch grooves **254-4** are sized and shaped to retain and prevent rotation of the clutch plate assembly **260** (to be described in detail later).

The collet **256** includes a first end **256-100** and a second end **256-200**. The first end **256-100** defines an extension rod channel **256-110**. The extension rod channel **256-110** is sized and shaped to receive the extension rod **178** (to be described in detail later). The first end **256-100** further includes an externally threaded portion **256-120**. The externally threaded portion **256-120** is sized and shaped for removable connection with the release ring **252** (to be described later). The first end also includes compression voids **256-130**.

The second end **256-200** of the collet **256** includes an extension rod channel **256-210** sized and shaped to receive the extension rod **178** (to be described in detail later). The second end **256-200** includes a externally threaded portion **256-220**. The externally threaded portion **256-120** is sized and shaped for removable connection with the clutch tightening ring **258** (to be described later). The second end **256-200** also includes clutch grooves **256-230**. The clutch grooves **256-230** are sized and shaped to retain and prevent rotation of the clutch plate assembly **260** (to be described in detail later).

The clutch plate assembly **260** includes a clutch plates **260-1**. The clutch plate **260-1** can include an interior protrusion **260-11** and/or an exterior protrusion **260-12**. The clutch plate **260-1** will include either an interior protrusion **260-11** or an exterior protrusion **260-12**. The clutch plate assembly **260** can include a plurality of clutch plates **260-1**.

The clutch tightening ring **258** includes an internally threaded surface **258-1**. The internally threaded surface **258-1** is adapted for removable connection with the collet **256** (to be described in detail later). The clutch tightening ring **258** also includes a tool void **258-2**. The tool void **258-2** is adapted to allow a ring removal tool to remove the clutch tightening ring **258** (to be described in detail later).

In the wheelchair mount **250**, the collet **256** is inserted through the collet opening **254-5** and is disposed within the collet channel **254-3** of the mounting collet **254**, such that the second end **256-200** of the collet **256** is proximate the collet opening **254-5** of the mounting collet. The clutch plate assembly **260** is disposed within the collet channel **254-3** of the mounting collet **254**, such that the interior protrusions **260-11** of the clutch plate assembly **260** are disposed within the clutch grooves **256-230** of the collet **256** and the exterior protrusions **260-12** of the clutch plate assembly **260** are disposed within the clutch grooves **254-4** of the mounting collet **254**. The internally threaded surface **258-1** of the

clutch tightening ring **258** removably connects with the externally threaded portion **256-220** of the collet **250**. The internally threaded surface **252-1** of the release ring **252** removably connects with the externally threaded portion **256-120** of the collet **250**. The clutch tightening ring **258** and/or the release ring **252** can be tightened or loosened with the aid of a ring removal tool. By this arrangement, the extension rod **179** can be variable positioned and tightly secured within the wheelchair mount **250**. Further, removal or loosening of the clutch tightening ring **258** is necessary only when disassembling the wheelchair mount **250**. Repositioning of the extension rod **179** only requires the loosening and tightening of the release ring **252**.

Wheelchair Mount—Third Variation

The third variation of the wheel chair mount **270** includes a mounting bracket **272** and a mounting clip **274**. FIG. **50** is an isometric view of an alternate embodiment of the mounting bracket of the present invention. FIG. **51** is a isometric view of the wheelchair mount of the present invention. FIG. **52** is a cross sectional view of the wheelchair mount of FIG. **51**.

The mounting bracket **272** includes a wheelchair mounting plate **272-1**, a clip wall **272-2**, and a fastener wall **272-3**. The mounting plate **272-1** includes a wheelchair fastener void **272-11**. A fastener (not shown) can be disposed in the wheelchair fastener void **272-11** to secure the mounting bracket **272** to a wheelchair (not shown). The clip wall **272-2** includes a first slanted surface **272-21**, a second slanted surface **272-22**, and a clip stop **272-23**. The fastener wall **272-3** includes an extension bar stop **272-31** and a clip fastener void **272-32**.

The mounting clip **274** includes a bar contact surface **274-1**, a first slanted contact surface **274-21**, and a second slanted contact surface **274-22**. The bar contact surface **274-1** includes a fastener void **274-11**.

In the wheelchair mount **270**, the mounting clip **274** is disposed between the first and second slanted surfaces **272-21**, **272-22**, and the clip stop **272-23** of the mounting bracket **272**, such that the first slanted contact surface **274-21** of the mounting clip **274** is adjacent to the first slanted surface **272-21** of the mounting bracket **272**, and the second slanted contact surface **274-22** of the mounting clip **274** is adjacent the second slanted surface **272-22** of the mounting bracket. Further, the fastener void **274-11** of the mounting clip **274** is operatively aligned with the clip fastener void **272-32** of the mounting bracket. By this arrangement, the extension rod **179** can be disposed between the clip and fastener walls **272-2**, **272-3** and the mounting clip **274**. A fastener can be inserted into the fastener void **274-11** of the mounting clip **274** and the clip fastener void **272-32** of the mounting bracket. As the fastener (not shown) is tightened, the mounting clip **274** and the mounting bracket **272** secure the extension rod **179**.

Connecting Assembly—Second Embodiment

A second embodiment of the connecting assembly is connector **500**. FIG. **3** is an isometric view of an alternate embodiment of the head array of the present invention which includes structure of the connector **500**. The connector **500** includes extension rod **179**, an extension joint **170**, alternate ball mount **340** and a first and second half ball mount receiver **188** and **184**, respectively, and wheelchair mounts **210**, **250**, or **270**.

Ball Mount and First and Second Half Ball Mount Receiver—Second Embodiment

FIG. **15** is an isometric view of an alternate embodiment of the ball mount of the present invention. A ball mount **340** includes a ball portion **340-1** and a support portion **340-2**. FIGS. **16A** and **16B** are isometric views of an alternate embodiment of the first half ball mount receiver of the present invention. An alternate first half ball receiver **332** includes an alternate channel **332-1**, an alternate ball mount void **332-2**, and an alternate ball mount contact surface **332-3**. The alternate first half ball receiver **332** can be used with the second half ball mount receiver **184**, as shown in the drawing figures and described above.

Material Selection—Preferred Embodiments

In a preferred embodiment of the present invention, the materials used to fabricate the various components are preferably lightweight materials with corrosion-resistant finishes. Preferably, these finishes are black.

The plates discussed above (e.g., occipital plate **194**, etc.) are preferably covered with padding, fabric, and/or other similar material at least on the surfaces that may contact portions of the user's body for comfort.

In general, where components are welded together, the components are preferably made of similar materials (i.e., steel to steel, aluminum to aluminum, etc.) Furthermore, where components experience forced engagement (i.e., compressive joints, threaded joints, etc.), the components are preferably made of dissimilar materials to prevent galling, seizing, etc. The preferred material is specified for the following components.

Temple arms **134** are preferably formed of steel with a high carbon content for spring tempering. This material provides temple arms **134** with elasticity and memory.

Swivel balls **126** and **132** are preferably formed of steel or stainless steel and provided with a corrosion-resistant finish. Swivel rings **122** and **124** are preferably formed of a material dissimilar to swivel balls to prevent galling or seizing. Such materials may include aluminum or soft steel. First swivel rings **122** may be formed of a different material from that of second swivel rings **124** and swivel balls **126** and **132**, depending on the material to which a particular swivel rings **124** or **122** is attached. For example, one particular swivel ring **122** is preferably formed of the same material as temple plate **192** so that the two can be welded to one another. Likewise, one particular swivel ring **124** is preferably formed of the same material as swing arm **154** so that these two can be welded to one another.

Swing lock **156** is preferably provided with a slippery coating so that its ramped surface preferably glides on the ramped surface of swing support **152** to prevent galling during the automatic engagement with the locking surfaces of swing support **152** and swing lock **156**. Alternately, the slippery coating may be applied to swing support **152** in place of or in addition to the coating applied to swing lock **156**.

Ball post **162** is preferably formed of stainless steel or steel with a corrosion-resistant finish.

Swing support **152** is preferably formed of aluminum.

Swing arm **154** is preferably formed of either aluminum, stainless steel, or steel and preferably similar to the material of first swivel ring **124** to which it may be welded.

Channels **164**, **168**, and **320** are .preferably formed of extruded aluminum.

First and second joint shells **174**, **172** are preferably formed of aluminum.

Wedge locks **176** are preferably formed of aluminum.

Extension rods **178**,**179** are preferably formed of stainless steel or steel with a corrosion-resistant coating. The joint

portion and the extension portion are formed of the same material preferably welded together.

Ball mount **182** is preferably formed of stainless steel or steel with a corrosion-resistant coating.

The plates (e.g., temple plates **192**, occipital plate **194**, sub-occipital plates **196**, or sub-occipital plate **310**) are preferably formed of aluminum, stainless steel, or steel with a corrosion-resistant coating. Alternately, the plates may also be formed of plastic or composite materials depending on manufacturing volume.

First half ball mount receiver **188** is preferably formed of aluminum so that it may be welded to channels **164** or **168**. Alternate first half ball mount receiver **332** is preferably formed of aluminum so that it may be welded to channel **320**.

Release ring **252** is preferably formed of aluminum. In any event, a friction washer may be disposed between release ring **252** and mounting collet **254**. Mounting collet **254** is preferably formed of extruded and machine aluminum although it may be formed of a single machined block of aluminum. Collet **256** is preferably formed of stainless steel or steel with a corrosion-resistant coating. The steel used preferably has sufficient elasticity.

Clutch plates **262, 264** are preferably stamped out of a mild steel and provided with a corrosion-resistant coating.

Clutch tightening ring **258** is preferably formed of aluminum.

It will be apparent to those skilled in the art that various modification and variations can be made in the adjustable head support for connection to a wheelchair of the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

I claim:

1. A head array for a wheelchair, comprising:

a temple support including a temple plate, a temple arm, and a swivel joint, the temple plate being operatively connected to the temple arm via the swivel joint;

an occipital support;

a sub-occipital support; and

a support structure for adjustably mounting the temple support, the occipital support and the sub-occipital support.

2. The head array for a wheel chair according to claim **1**, wherein said swivel joint comprises two swivel rings, said swivel rings having a swivel ball disposed therebetween, said swivel ball operatively connected to said temple plate and said temple arm, whereby tightening of said swivel rings prevents movement of said temple plate relative to said temple arm.

3. The head array for a wheel chair according to claim **1**, wherein the sub-occipital support comprises two sub-occipital plates.

4. The head array for a wheel chair according to claim **3**, wherein the sub-occipital support structure includes two swivel joints, each sub-occipital plate being attached to one of the swivel joints.

5. The head array for a wheel chair according to claim **1**, wherein the occipital support comprises an occipital plate.

6. The head array for a wheel chair according to claim **5**, wherein the occipital support structure includes a swivel joint, the occipital plate being attached to the swivel joint of the occipital support structure.

7. The head array for a wheel chair according to claims **6**, wherein said swivel joint comprises two swivel rings, said swivel rings having a swivel ball disposed therebetween, said swivel ball operatively connected to said occipital plate and said occipital support structure, whereby tightening of said swivel rings prevents movement of said occipital plate relative to said occipital support structure.

8. The head array for a wheel chair according to claim **1**, wherein the sub-occipital support comprises a sub-occipital plate.

9. The head array for a wheel chair according to claim **8**, wherein the sub-occipital support structure includes a swivel joint, the sub-occipital plate being attached to the swivel joint of the sub-occipital support structure.

10. The head array for a wheel chair according to claim **9**, wherein said swivel joint comprises two swivel rings, said swivel rings having a swivel ball disposed therebetween, said swivel ball operatively connected to said sub-occipital plate and said sub-occipital support structure, whereby tightening of said swivel rings prevents movement of said sub-occipital plate relative to said sub-occipital support structure.

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